

11053

U.S. Army Center for Health Promotion and Preventive Medicine

**PYROTECHNICS HEALTH RISK ASSESSMENT
NO. 39-EJ-1485-00
RESIDENTIAL EXPOSURE FROM INHALATION OF
AIR EMISSIONS FROM THE
M18 VIOLET-COLORED SMOKE GRENADE
DEPARTMENT OF DEFENSE IDENTIFICATION CODE: G955**

Prepared by:

Environmental Health Risk Assessment & Risk
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Prepared for:

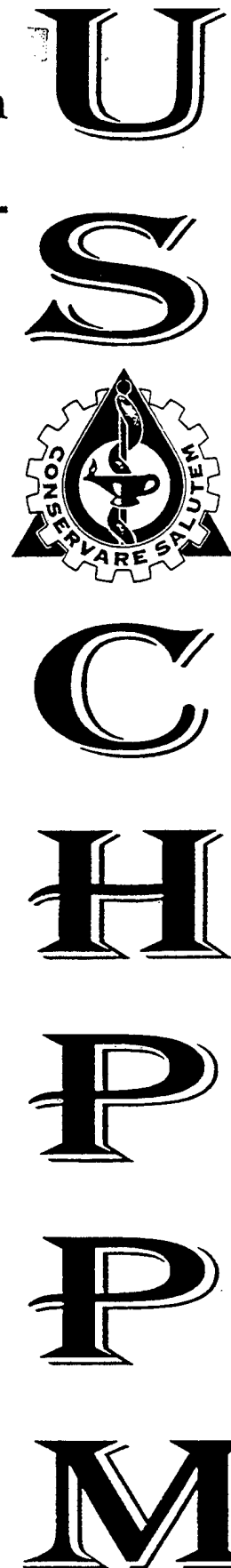
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Readiness Thru Health

U.S. Army Center for Health Promotion and Preventive Medicine

The lineage of the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) can be traced back over 50 years. This organization began as the U.S. Army Industrial Hygiene Laboratory, established during the industrial buildup for World War II, under the direct supervision of the Army Surgeon General. Its original location was at the Johns Hopkins School of Hygiene and Public Health. Its mission was to conduct occupational health surveys and investigations within the Department of Defense's (DOD's) industrial production base. It was staffed with three personnel and had a limited annual operating budget of three thousand dollars.

Most recently, it became internationally known as the U.S. Army Environmental Hygiene Agency (AEHA). Its mission expanded to support worldwide preventive medicine programs of the Army, DOD, and other Federal agencies as directed by the Army Medical Command or the Office of The Surgeon General, through consultations, support services, investigations, on-site visits, and training.

On 1 August 1994, AEHA was redesignated the U.S. Army Center for Health Promotion and Preventive Medicine with a provisional status and a commanding general officer. On 1 October 1995, the nonprovisional status was approved with a mission of providing preventive medicine and health promotion leadership, direction, and services for America's Army.

The organization's quest has always been one of excellence and the provision of quality service. Today, its goal is to be an established world-class center of excellence for achieving and maintaining a fit, healthy, and ready force. To achieve that end, the CHPPM holds firmly to its values which are steeped in rich military heritage:

★ Integrity is the foundation

★ Excellence is the standard

★ Customer satisfaction is the focus

★ Its people are the most valued resource

★ Continuous quality improvement is the pathway

This organization stands on the threshold of even greater challenges and responsibilities. It has been reorganized and reengineered to support the Army of the future. The CHPPM now has three direct support activities located in Fort Meade, Maryland; Fort McPherson, Georgia; and Fitzsimons Army Medical Center, Aurora, Colorado; to provide responsive regional health promotion and preventive medicine support across the U.S. There are also two CHPPM overseas commands in Landstuhl, Germany and Camp Zama, Japan who contribute to the success of CHPPM's increasing global mission. As CHPPM moves into the 21st Century, new programs relating to fitness, health promotion, wellness, and disease surveillance are being added. As always, CHPPM stands firm in its commitment to Army readiness. It is an organization proud of its fine history, yet equally excited about its challenging future.

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| 14. ABSTRACT This assessment evaluated the potential for human health effects to offsite residents breathing air emissions following use of the M19 Violet-Colored Smoke Grenade. This document present the evaluation of the potential for adverse human health effects to the offsite residents breathing air emissions following the use of military firing ranges during training exercises. Study results showed no potential for health risks to the hypothetical resident from inhalation of air emissions from the smoke grenade. To conduct this study, air emissions from the smoke grenade were collected in a test chamber (at West Desert Test Center, Dugway Proving Ground, UT). This information was then used in an air dispersion model to determine ambient air concentrations at a location downwind from the site where the item was activated. Modeled air concentrations were combined with exposure information to estimate the amount of substances the hypothetical resident breathes. This intake was combined with the substance's health information, to determine if there is a potential for health risks from inhalation of these substances. The health risk included both long-term and short term exposures to the modeled substance concentrations. Study results showed no potential for health risks from inhalation of air emissions from the M18 Violet-Colored Smoke Grenade. | | | | | |
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| U | U | U | UU | | 19b. TELEPHONE NUMBER (include area code) 410-436-6849 |



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5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUND, MARYLAND 21010-5403

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PYROTECHNICS HEALTH RISK ASSESSMENT NO. 39-EJ-1485-00
RESIDENTIAL EXPOSURE FROM INHALATION OF AIR EMISSIONS
FROM THE M18 VIOLET-COLORED SMOKE GRENADE

EXECUTIVE SUMMARY

This assessment evaluated the potential for human health effects to offsite residents breathing air emissions following use of the M18 Violet-Colored Smoke Grenade (violet-colored M18) during training exercises. The military uses pyrotechnics for signaling, obscuring, and illuminating during training and combat. Pyrotechnics are also used during training exercises to simulate battle conditions. Study results showed that no adverse health effects are expected, to the hypothetical resident, from inhalation of the air emissions from the violet-colored M18.

To conduct this study, air emissions from the violet-colored M18 were collected in a test chamber (Bang Box) at Dugway Proving Ground, Utah. The data collected from the Bang Box study provided the amount and types of substances released from the violet-colored M18. This information was then used in an air dispersion model to determine ambient air concentrations at a location 100 meters (328 feet) downwind from a site where the violet-colored M18 may be used. Since the training facility in this study is hypothetical, the air model used assumptions that provided conservative estimates of air concentrations.

Modeled air concentrations were combined with exposure information (e.g., number of exposures per year) to estimate the amount of each substance the hypothetical resident breathes. This intake was combined with the substance's health information, which was obtained from agencies such as the U.S. Environmental Protection Agency, to determine if there is a potential for health risks from inhalation of these substances.

The health risk study included both long-term (30 years) and short-term (15-minute or 1-hour) exposures to modeled substance concentrations. Study results showed that no adverse health effects are expected to be experienced, by the hypothetical resident, from inhalation of air emissions from the violet-colored M18.

TABLE OF CONTENTS

| | |
|---|----|
| 1. PURPOSE..... | 1 |
| 2. AUTHORITY..... | 1 |
| 3. REFERENCES..... | 1 |
| 4. BACKGROUND..... | 1 |
| a. PYROTECHNICS AND THEIR USE..... | 1 |
| b. WHAT IS THE VIOLET-COLORED M18?..... | 1 |
| c. USE OF THE VIOLET-COLORED M18 | 2 |
| d. ASSESSMENT SUMMARY..... | 2 |
| 5. METHODS AND DATA COLLECTION..... | 3 |
| a. EMISSION FACTORS..... | 3 |
| b. AIR MODEL | 3 |
| c. EXPOSURE ASSESSMENT | 7 |
| d. TOXICITY ASSESSMENT | 11 |
| 6. RISK CHARACTERIZATION | 15 |
| a. CHRONIC HEALTH RISK..... | 15 |
| b. ACUTE HEALTH RISK..... | 15 |
| c. FACT SHEET | 15 |
| 7. UNCERTAINTY DISCUSSION..... | 16 |
| 8. CONCLUSION..... | 18 |
| 9. RECOMMENDATIONS | 18 |
| 10. POINT OF CONTACT | 18 |

LIST OF APPENDICES

| | |
|---|------------|
| REFERENCES | APPENDIX A |
| AIR DISPERSION MODELING OUTPUT DATA | APPENDIX B |
| HEALTH-BASED SCREENING LEVELS AND ACUTE TOXCITY VALUES | APPENDIX C |
| RISK EVALUTION DATA | APPENDIX D |
| FACT SHEET SUBMITTED TO AEC | APPENDIX E |

LIST OF TABLES

| | |
|---|----|
| TABLE 1 – SOURCE PARAMETERS | 4 |
| TABLE 2 – WORST-CASE METEOROLOGICAL PARAMETERS | 4 |
| TABLE 3 – AIR MODEL INPUT PARAMETERS | 5 |
| TABLE 4 – FREQUENCY OF USE FOR THE VIOLET-COLORED M18 | 7 |
| TABLE 5 – EXPOSURE PARAMETERS USED TO DETERMINE TIME-AVERAGED CHRONIC AIR CONCENTRATIONS | 8 |
| TABLE 6 – SUMMARY OF RfCs USED FOR PETROLEUM HYDROCARBONS | 13 |
| TABLE 7– TYPES OF UNCERTAINTY | 16 |

LIST OF ACRONYMS

| | |
|------------------|---|
| AEC | U.S. Army Environmental Center |
| AEGL | Acute Exposure Guideline Levels |
| AIHA | American Industrial Hygiene Association |
| ATV | Acute Toxicity Value |
| DOE | U.S. Department of Energy |
| EPA | U.S. Environmental Protection Agency |
| ERPG | Emergency Response Planning Guidelines |
| HBSL | Health-Based Screening Level |
| HCl | Hydrogen Chloride |
| NAAQS | National Ambient Air Quality Standards |
| NAC/AEGL | National Advisory Committee for Acute Exposure Guideline Levels |
| NEW | Net Explosive Weight |
| OEL | Occupational Exposure Limit |
| PM ₁₀ | Particulate Matter under 10 micrometers in size |
| PRG | Preliminary Remediation Goals |
| RBC | Risk-Based Concentration |
| RfC | Reference Concentration |
| TEEL | Temporary Emergency Exposure Limits |
| TPHCWG | Total Petroleum Hydrocarbon Criteria Working Group |
| TSP | Total Suspended Particulates |
| USACHPPM | U.S. Army Center for Health Promotion and Preventive Medicine |

PYROTECHNICS HEALTH RISK ASSESSMENT NO. 39-EJ-1485-00
RESIDENTIAL EXPOSURE FROM INHALATION OF AIR EMISSIONS FROM THE
M18 VIOLET-COLORED SMOKE GRENADE

1. PURPOSE

This document presents the evaluation of the potential for adverse human health effects to offsite residents breathing air emissions following use of the M18 violet-colored smoke grenade (violet-colored M18) during training exercises.

2. AUTHORITY

Memorandum, U.S. Army Environmental Center, 4 June 1999, Subject: Pyrotechnics Risk Assessment.

3. REFERENCES

See Appendix A.

4. BACKGROUND

a. PYROTECHNICS AND THEIR USE

The term pyrotechnic is derived from the Greek words "pyr" and "techne" meaning fire and art. The terms pyrotechnics and fireworks are often used interchangeably. Examples of pyrotechnics include distress flares and fireworks used for commercial (public displays) and consumer use (e.g., sparklers). Every year, during New Year's Eve and Independence Day, fireworks are used for public displays across the country. For example, during the Year 2000 Independence Day celebration in New York City, 60,000 shells were launched during a firework display that lasted for 30 minutes.

The military uses pyrotechnics for four purposes: 1) as a method of communication through the use of signals, 2) to produce smoke to reduce enemy effectiveness, 3) for illuminating the field, and 4) to simulate battle conditions during training exercises. Pyrotechnics play an important role in both military training and combat. It is important that our troops are adequately trained to use them properly.

b. WHAT IS THE VIOLET-COLORED M18?

The M18 smoke grenade is a type of pyrotechnic device used by troops for ground-to-ground or ground-to-air signaling (Reference 1). The M18 may be filled with one of four different smoke colors. These different colored smoke

signals can be seen over great distances when used against a terrain background of contrasting colors.

The violet-colored M18 is 5.75 inches long, 2.50 inches in diameter, and weighs 19 ounces (Reference 2). The body of the violet-colored M18 consists of a thin cylinder of sheet metal that is filled with a violet smoke mixture and a starter mixture composed mostly of potassium nitrate.

c. USE OF THE VIOLET-COLORED M18

The M18s are used during many Army training events. These events are held at nearly every Army training installation. At most locations, the training areas are at least 1000 meters (over half a mile) away from populated areas. In general, five violet-colored M18s are used during a day of training, which typically occurs five times per year.

The M18 contains a delay-igniting fuze so that smoke is not released immediately after the grenade is activated. This allows the soldier to throw the grenade, usually to a distance of approximately 35 meters (115 feet), before smoke is produced. The M18 will emit a cloud of colored smoke for 50 to 90 seconds. This colored smoke can be used for different purposes. For example, it can be used to mark friendly force locations for other ground troops. It can also be used to mark a landing zone during operations such as medical evacuation (Reference 3).

d. ASSESSMENT SUMMARY

The approach for this study consisted of two main portions: air dispersion modeling and exposure assessment. These are briefly discussed in the paragraphs below. Sections 5-7 present a more explicit discussion of the methodology used for this study.

Emissions data generated from the studies in the Bang Box at Dugway Proving Ground, Utah (Reference 4), were used with an atmospheric dispersion model to estimate the average concentrations that may be experienced by an offsite resident. Since this study is designed to provide results that would be applicable to most Army training facilities, the training area used in this evaluation was a hypothetical one. In addition, air-modeling parameters were selected to mimic worst-case conditions.

The exposure assessment included calculations of time-averaged concentrations for both long-term (chronic) and short-term (acute) exposures. For the purpose of this study, air concentrations were averaged over 30 years for chronic exposures and 1-hour or 15 minutes for acute exposures. These concentrations were compared to chronic health-based screening levels

(HBSLs) established by the U.S. Environmental Protection Agency (EPA) or acute toxicity values (ATVs) established by selected agencies depending on the exposure duration (i.e., 30 years versus 1-hour or 15 minutes). If the chronic or acute averaged concentrations (C_{chronic} and C_{acute}) were greater than these screening levels, further analysis would be warranted to determine the potential for health effects. It should be noted that concentrations greater than the screening levels do not indicate an onset of health effects, but rather the potential for such.

5. METHODS AND DATA COLLECTION

a. EMISSION FACTORS

Emission factors used to derive the air modeling emission rates used in this study were generated from the pyrotechnics emissions studies conducted in the Bang Box at Dugway Proving Ground, Utah (Reference 4). The Bang Box studies identified and quantified air emissions from the firing of training munitions. The data provided by the Bang Box studies included the net explosive weight (NEW) of the item, the compounds sampled, and compound-specific emission factors. Emissions data from the Bang Box studies are included in the first four columns of the air dispersion modeling output data in Appendix B.

b. AIR MODEL

(1) BACKGROUND

Air dispersion models are available to mathematically simulate plume behavior to estimate downwind concentrations of compounds emitted from various sources. However, specific models are not available to determine the dispersion of emissions from munitions used during training. Estimating the magnitude and location of these concentrations depends on many factors including the amount and type of emissions, the behavior of the source, and meteorological conditions. Since a specific model is not available for modeling the use of munitions during training, the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) evaluated numerous air models to determine which would be suitable for use with munitions used during training. The USACHPPM recommended using the Integrated PUFF (INPUFF) model to estimate the dispersion of emissions from sources such as pyrotechnics (Reference 5).

(2) MODEL DESCRIPTION

The INPUFF Model (Reference 6) was developed to simulate dispersion from instantaneous or semi-continuous point sources. This Gaussian-integrated puff model is capable of addressing a cloud type release over short periods of

time, and computations can be performed for a single point source for multiple receptors. The algorithms used to calculate concentrations assume a vertically uniform wind direction (with no chemical reaction) to compute the contribution of each cloud at a receptor for each time step/interval.

(3) ASSUMPTIONS

Some assumptions were made to best represent the violet-colored M18 in the air model. These assumptions were as follows:

- (a) Initial cloud dimensions are preferred to model the air emissions from these types of releases. However, this information was not measured during the Bang Box studies; therefore, assumptions had to be made. Typically, with conventional point sources, the cloud rise and formation are determined by characterizing flue gas exit velocity, temperature, and stack diameter. However, for unconventional sources with no physical stack dimensions, such as the violet-colored M18, the cloud temperature was set close to the ambient temperature, and a low exit velocity (0.1 meter per second) was used. Using a low exit velocity assumes essentially no cloud rise resulting in higher ground level concentrations to provide a more conservative estimate of air emissions. The source parameters used to model the violet-colored M18 are included in Table 1.

TABLE 1: SOURCE PARAMETERS

| | |
|-------------------------|--------------------------------------|
| Source/Stack Diameter | 0.061 meters |
| Source/Stack Height | 0.15 meters |
| Source Exit Temperature | 298.15 degrees Kelvin (°K)(or 77 °F) |
| Exit Velocity | 0.1 meters/second |

- (b) Since this study does not look at a specific training site, generic, worst-case meteorological data were used. To determine the worst-case meteorological conditions that would result in the highest air emission concentrations, an analysis was performed using the EPA Risk Management Program Guidance (Reference 7). This guidance includes tables for estimating the footprint of chemical releases. These guidelines are intended to inform emergency responders of potential accidental releases. The EPA has defined most default conditions for meteorological modeling parameters. Table 2 lists the meteorological parameters that were used in the air model.

TABLE 2: WORST-CASE METEOROLOGICAL PARAMETERS

| | |
|-----------------------|------------------------------------|
| Wind Speed | 1 meter/second |
| Atmospheric Stability | Category F |
| Wind Direction | 270° |
| Ambient Temperature | 293 degrees Kelvin (°K) (or 68 °F) |

- (c) For the purposes of this study, a hypothetical offsite resident was assumed to be located 100 meters directly downwind from the source. The meander of the cloud is a major factor when estimating concentrations at given locations downwind from the source. Assuming that the resident is directly downwind from the source is the same as assuming that there is no cloud meander and therefore the cloud remains more concentrated. This assumption provides the most conservative modeled concentrations.

(4) GENERAL METHODOLOGY

- (a) For the violet-colored M18, the highest modeled concentrations were seen at the 100-meter location. This means that concentrations at distances greater than 100 meters were lower. This location was used in the exposure evaluation to provide the most conservative estimates of air emissions that offsite residents may be exposed.
- (b) The model was run for a total calculation time of 900 seconds (15 minutes) to ensure that the total mass of the cloud had passed the receptor locations and to acquire 15-minute average concentrations for use in the exposure evaluation. Concentrations were calculated every two seconds. The model indicated that the initial cloud reached the hypothetical offsite resident within 80 seconds and dissipated below the lowest concentration the model calculated, which in this instance ($1 \times 10^{-10} \text{ g/m}^3$) occurred within 240 seconds. Table 3 contains the air model input parameters used in this study.

TABLE 3: AIR MODEL INPUT PARAMETERS

| | |
|---|-------------|
| Number of meteorological periods (NTIME) | 1 |
| Duration of each meteorological period (ITIME) | 900 seconds |
| Number of updates to the source (NSRCDS) | 15 |
| Duration/time step between each source update (ISUPDT) | 60 seconds |
| Total time modeled/Simulation Period (NTIME) (ITIME)= (NSRCDS) (ISUPDT) | 900 seconds |

(5) USE OF MODEL OUTPUT

The concentrations provided by the INPUFF model were based on a unit emission rate of 1 gram/second from an emission source and did not represent any pollutant-specific concentrations from the use of pyrotechnics. This unit emission rate is typically used for ease of modeling purposes. The relationship between the emission rate and predicted concentration is linear. Therefore, the ratio of the predicted concentration to the unit emission rate was multiplied by each pollutant-specific emission rate to provide pollutant-specific concentrations.

(6) DETERMINATION OF POLLUTANT-SPECIFIC EMISSION RATES

- (a) The actual pollutant emission rate per item (ER_1) for each pollutant was calculated using the following equation:

$$ER_1 = \frac{M \cdot CV}{t} \quad \text{Equation 1}$$

where:

ER_1 = emission rate for one item (g/(item*sec))

M = total mass (lb) of pollutant emitted per item (lb/item)

CV = conversion factor (453.59 g/lb)

t = release duration in seconds as obtained from the training manual (References 2, 8)

Example 1

Sample Calculation Using Equation 1:

$$ER_1 = \frac{(1.169E-01)(453.59)}{(120)}$$

$$= 4.418E-01 \text{ g/(s*item)}$$

Calculation provided for total suspended particulates (TSP). Averaged adjusted emission factor of TSP in lb/item was obtained from Appendix B.

- (c) Pollutant-specific ambient concentrations for one item (CONC) were calculated using the following equation:

$$CONC = ER_{EV} \cdot \frac{UC}{ER_{unit}} \quad \text{Equation 2}$$

where:

CONC = pollutant concentration based on one item (g/m³)
 ER₁ = emission rate for one item (g/s)
 ER_{unit} = unit emission rate as used in the model (g/sec)
 UC = concentration based on the unit emission rate (g/m³)

Example 2

Sample Calculation Using Equation 2:

$$CONC = (4.418E-01) \frac{(3.510E-03)}{(1)}$$

$$= 1.550E-03 \text{ g/m}^3$$

Calculation provided for TSP.

c. EXPOSURE ASSESSMENT

(1) EXPOSURE ASSUMPTIONS

- (a) Exposure assumptions were selected using a typical use scenario for the violet-colored M18. This use scenario was provided by the U.S. Army Environmental Center (AEC), and is based on consultation with their senior training advisor (References 9, 10). This information is included below in Table 4 and is used for the chronic and acute exposure evaluations.

TABLE 4: FREQUENCY OF USE FOR THE VIOLET-COLORED M18

| Parameter | Value Used |
|--|------------|
| Number of items used per training scenario | 5 |
| Number of items used per training event | 2-3 |
| Number of events per scenario | 2 |
| Time between events | 12 hours |
| Number of scenarios per year | 5 |

- (b) The frequency of use for the violet-colored M18 was required to determine how much substance an offsite resident would be exposed to in the time period of interest (i.e., acute or chronic exposure). For the purposes of this study, a training scenario is defined as a day or session of training whereas a training event is defined as a single use of pyrotechnics. A training scenario may consist of multiple training events. An event may consist of the use of two to three items (not to exceed a maximum estimated use of five items per scenario).

(2) TIME-AVERAGING

- (a) For the chronic assessment, time-averaged concentrations were calculated using the EPA's default residential exposure duration of 30 years (this value assumes that the resident spends 30 years at the same residence). This was done to derive concentrations that would be consistent with the exposure duration used by the EPA so that estimated substance concentrations could be compared to their respective health-based screening levels.
- (b) In this evaluation, training scenarios were assumed to occur five times a year (References 9, 10). Using the default residence time established by the EPA, the assumption was made that someone could be exposed to five training scenarios per year for 30 years. Table 5 lists the exposure parameters used to estimate concentrations for the chronic assessment. These parameters are based on the typical use scenario provided by AEC (Table 4) and the assumptions used in the air model run.

TABLE 5: EXPOSURE PARAMETERS USED TO DETERMINE TIME-AVERAGED CHRONIC AIR CONCENTRATIONS

| Exposure Parameter | Value Used |
|---|------------------------------|
| Exposure Time (ET) | 15 minutes/item ¹ |
| Exposure Frequency (EF _{day}) | 5 items/day ² |
| Exposure Frequency (EF _{year}) | 5 days/year ² |
| Exposure Duration (ED) | 30 years ³ |
| ¹ Based on the total model time of 900 seconds (15 minutes) used in the air model run. | |
| ² From Table 4. | |
| ³ EPA default value. | |

- (c) The daily averaged concentrations were calculated using Equation 3. To continue with the examples used previously (Examples 1 and 2), TSP is used to illustrate how this equation is applied. It should be noted that the average

modeled concentration was converted from g/m^3 to $\mu\text{g/m}^3$ before it was used in Equation 3.

$$C_d = \frac{\text{CONC} \cdot \text{ET} \cdot \text{EF}_{\text{day}}}{1440} \quad \text{Equation 3}$$

where:

C_d = average daily concentration ($\mu\text{g/m}^3$)
 CONC = average modeled concentration for one item ($\mu\text{g/m}^3$)
 ET = exposure time (minutes/item)
 EF_{day} = exposure frequency (items/day)
 1440 = unit conversion from minutes to day

Example 3
Sample Calculation Using Equation 3:

$$C_{d(\text{TSP})} = \frac{(1.550\text{E} + 03)(15)(5)}{1440}$$

$$= 8.078\text{E}+01 \mu\text{g/m}^3$$

The averaged modeled concentration (CONC) for TSP was obtained from Appendix B. The exposure parameters were obtained from Table 5.

(d) Chronic averaged concentrations were calculated using Equation 4. The resulting concentration (C_d) from Equation 3 was used in Equation 4 to determine the averaged chronic concentrations. Example 4 shows how this calculation was performed.

$$C_{\text{chronic}} = \frac{C_d \cdot \text{EF}_{\text{year}} \cdot \text{ED}}{\text{AT}} \quad \text{Equation 4}$$

where:

C_{chronic} = average chronic concentration ($\mu\text{g/m}^3$)
 C_d = average daily concentration ($\mu\text{g/m}^3$)
 EF_{year} = exposure frequency (days/year)
 ED = exposure duration (years)

AT = averaging time (days)
(for carcinogenic endpoint, $AT = 70 \text{ years} \times 365 \text{ days}$;
noncarcinogenic endpoint, $AT = ED \times 365 \text{ days}$)

Example 4
Sample Calculation Using Equation 4:

$$C_{\text{chronic}(TSP)} = \frac{(8.078E+01)(5)(30)}{(30)(365)}$$

$$= 1.11E+00 \mu\text{g}/\text{m}^3$$

The average daily concentration was calculated as shown in Example 3. The exposure parameters were obtained from Table 5.

- (e) Unlike the chronic evaluation, guidance for evaluating acute exposures is not currently available. Due to the nature of the use of pyrotechnics, acute exposures cannot be overlooked. For the purpose of this study, acute exposure is defined as a 1-hour or 15-minute exposure. The 1-hour or 15-minute acute exposure averaging times allow for comparison with guidelines developed specifically for emergency planning purposes (see discussion on acute toxicity below).
- (f) The exposure frequency is based on the number of events per 1-hour or 15 minutes depending on the guideline used for comparison. This information is based on the use scenario provided by AEC (Table 4). To determine the maximum number of items that may be used in 1-hour, it was conservatively assumed that three violet-colored M18s might be activated all at once during an event. This assumption is based on the fact that two to three items may be used within a 12-hour period (one event). The average acute concentrations were computed using Equation 5. Example 5 contains a sample calculation of this equation. Since TSP does not have an acute toxicity value, chromium (Cr) is used as the example compound.

$$C_{\text{acute}} = \frac{CONC \cdot ET \cdot EF_{\text{hour}}}{60}$$

Equation 5

where:

C_{acute} = average acute concentration ($\mu\text{g}/\text{m}^3$)
 $CONC$ = average modeled concentration for one item ($\mu\text{g}/\text{m}^3$)
 ET = exposure time (minutes/item)
 EF_{hour} = exposure frequency (items/hour)

60 = unit conversion, 60 minutes/hour

Example 5
Sample Calculation Using Equation 5:

$$C_{acute(Cr)} = \frac{(4.046E-03)(3)(15)(1/0.25)}{60}$$
$$= 1.21E-02 \mu\text{g}/\text{m}^3$$

The average modeled concentration (CONC) for Cr was obtained from Appendix B. Since the acute toxicity value for Cr is based on a 15-minute exposure duration (TEEL), the acute concentration was averaged over 15 minutes (0.25 hours) so that C_{acute} can be compared with its toxicity value.

d. TOXICITY ASSESSMENT

The potential for adverse health effects was determined by comparing time-averaged air concentrations to health-based screening levels, which are developed from a substance's known toxicity. These toxicity values typically include different levels of safety factors depending on the level of confidence of the critical study. Appendix C contains a table of screening values used for the chronic and acute evaluations.

(1) CHRONIC ASSESSMENT

- (a) The chronic assessment was evaluated using a screening approach. Using this method, a substance's estimated time-averaged air concentration was compared to its HBSL. If this ratio was less than one, no further analysis was required. This approach is conservative because the exposure assumptions used by the EPA, to establish HBSLs, assume that the resident is exposed for 350 days per year (assuming 2 weeks vacation per year). Since the training scenarios, in which the violet-colored M18 is used, are not expected to exceed five days per year, HBSLs specific to this study (if they were developed) would likely be higher.
- (b) The HBSLs were obtained from the EPA, primarily from Region 3 and Region 9 (References 11, 12). To ensure that the most recent information was used, the Internet sites of both regions were checked. Although the general approach used by both Region 3 and Region 9 is the same, the exposure assumptions differ enough so that final recommended screening levels can vary to a certain degree. In both methods a substance's HBSL is selected using the toxicity endpoint that derives a lower concentration. For example, if a substance has a known systemic toxicity and is a carcinogen, concentrations were calculated using both toxicity values. To maintain a

conservative approach, the lower concentration was selected as the recommended screening level.

- (c) A hierarchy was developed in order to quantitatively evaluate for as many of the identified substances as possible. Since the methodology used by Region 9 results in lower HBSLs than Region 3, the Region 9 preliminary remediation goals (PRGs) were used first. Region 3's risk-based concentrations (RBCs) were only used when a PRG was not available. The only exception was for chromium (VI) [Cr (VI)] where Region 9 used a carcinogenic toxicity value that was seven times greater than the EPA's recommended value to develop its screening level for inhalation exposure (Reference 13). Since the EPA does not advocate the application of this multiplication factor, the RBC for Cr (VI) was used instead of the PRG.
- (d) Some substances have neither PRGs nor RBCs because they have their own set of regulatory standards. Under the Clean Air Act, the EPA is required to establish National Ambient Air Quality Standards (NAAQS) (Reference 14) for several substances considered harmful to public health and the environment. Currently, NAAQS are available for six substances, of which carbon monoxide, nitrogen dioxide, lead, sulfur dioxide, and particulate matter < 10 micrometers (PM₁₀) have been detected in the violet-colored M18 Bang Box study. The NAAQS for the longer averaging time were used for the chronic evaluation. Depending on the substance, this can range from an 8-hour average to an annual average. In addition, since the majority of the measured TSP were PM₁₀ (Reference 4), the NAAQS for PM₁₀ was used to evaluate the potential for health effects from exposure to TSP. Example 6 shows a sample calculation of how a substance's estimated chronic concentration is compared to its HBSL.

Example 6

Sample Calculation Comparing a Substance's Estimated Chronic Concentration to Its HBSL:

$$\frac{C_{\text{chronic(TSP)}}}{\text{HBSL}} = \frac{1.11\text{E} + 00}{50}$$
$$= 2.22\text{E}-02 < 1$$

In this case, the resulting ratio is nearly two orders of magnitude less than one, indicating further evaluation is not necessary.

- (e) Many petroleum hydrocarbons were detected but do not have specific screening levels. Therefore, the approach recommended by the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG) (Reference 15)

was adopted to evaluate petroleum hydrocarbon mixtures. Based on the working group's assessment of various hydrocarbons, it was recommended that mixtures be separated according to a substance's number of carbons and its chemical class (i.e., aliphatic or aromatic¹). Generally, as a substance's carbon number increases, its molecular weight increases and it is therefore, not a substance of concern via inhalation. The working group also concluded that aromatic hydrocarbons tend to be more toxic than aliphatic hydrocarbons (Reference 15).

(f) Table 6 tabulates the inhalation toxicity values used to evaluate exposure to petroleum mixtures. To be consistent with the methodology used in this study, the reference concentrations (RfCs) were converted to PRGs using Region 9 assumptions. The resulting PRGs are included in Table D-4 in Appendix D.

TABLE 6: SUMMARY OF RfCs USED FOR PETROLEUM HYDROCARBONS¹

| Carbon Range | Aromatic Inhalation RfC (mg/m ³) | Aliphatic Inhalation RfC (mg/m ³) |
|---|--|---|
| C ₅ - C ₆ C _{>6} - C ₈ | | 18.4 |
| C _{>7} - C ₈ | 0.4 | |
| C _{>8} - C ₁₀ C _{>10} - C ₁₂ C _{>12} - C ₁₆ | 0.2 | 1.0 |
| C _{>16} - C ₂₁ C _{>21} - C ₃₅ | NA | NA |
| ¹ Reference 15 NA = not applicable for high molecular weight TPHs (C _{>16}) because compounds in this carbon range are not volatile and therefore, inhalation is not a pathway of concern. | | |

(2) ACUTE ASSESSMENT

(a) As previously indicated, an acceptable method for assessing acute health effects is not currently available. It was not until recently that EPA guidance addressed the need to evaluate acute health effects from inhalation (Reference 17). Even then, acute toxicity data for risk assessment purposes were not readily available. The EPA recognized this deficiency and spearheaded the National Advisory Committee for Acute Exposure Guideline Levels for Hazardous Substances (NAC/AEGL Committee). Currently,

¹ Aliphatic hydrocarbons are hydrocarbons in which the carbon atoms are joined by single covalent bonds consisting of two shared electrons (e.g., butane). Aromatic hydrocarbons have ring structures (e.g., benzene) (Reference 16).

AEGLs are available for only a handful of substances, of which only one is found in the list of detected compounds from the violet-colored M18 emissions data.

- (b) To circumvent this problem, several state regulatory agencies have suggested that guidelines developed for emergency purposes be used in the interim. Although suggestions have been made to use occupational exposure limits (OELs) by applying additional safety factors (References 18, 19), OELs were not used in this study because they introduce even more uncertainty than the use of emergency guidelines. The OELs are designed to protect the workplace environment and assume 8 hours a day, 5 days a week exposures. By definition, these exposures are more chronic than acute.
- (c) In comparison, emergency planning guidelines are more appropriate because they are typically developed for exposures of 1-hour or less. In addition, safety factors may also have been included depending on the agency that develops these guidelines, so that the values would be protective of the general population.
- (d) Emergency Response Planning Guidelines (ERPGs) published by the American Industrial Hygiene Association (AIHA) (Reference 20) and the Temporary Emergency Exposure Limits (TEELs) developed by the U.S. Department of Energy (DOE) (Reference 21) were used for this study, specifically the ERPG-1s and the TEEL-1s (with the exception of the three AEGLs that were available). Since TEEL-1s are intended for 15-minute exposures, air concentrations compared to TEELs were averaged over a 15-minute period. Air concentrations compared to ERPGs and AEGLs were averaged over 1-hour, as these values were developed for 1-hour exposures.
- (e) The AIHA defines ERPG-1 as follows:

"The maximum concentration in air below which it is believed nearly all individuals could be exposed for up to one hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor."

The DOE defines TEEL-1 as follows:

"The maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor."

- (f) For this study, AEGLs were used first when available since they are developed specifically for the purposes of acute exposure evaluations. ERPGs were selected next, prior to a substance's TEEL, because they are vigorously reviewed before they are published whereas the TEELs are not. Example 7 shows a sample calculation of how a substance's estimated acute concentration is compared to its acute toxicity value.

Example 7

Sample Calculation of Comparing a Substance's Estimated Acute Concentration to Its Acute Toxicity Value:

$$\frac{C_{acute}(Cr)}{ATV} = \frac{1.21E-02}{1.50E+03}$$
$$= 8.06E-06 < 1$$

In this example with Cr, the ratio is more than five orders of magnitude below 1, indicating that further analysis is not necessary.

6. RISK CHARACTERIZATION

Appendix D presents results from the violet-colored M18 risk characterization. Note that for some substances, two concentrations were reported because of different analytical test methods (as noted in bold). In those instances, the higher concentration was used.

a. CHRONIC HEALTH RISK

The outcome indicated that no chronic health risks are expected from breathing the air emissions from the violet-colored M18. Since all ratios were below one, no further evaluation was needed.

b. ACUTE HEALTH RISK

For the acute analysis, all ratios were below one, indicating that no acute health impacts are expected from breathing the air emissions from the violet-colored M18. Since all ratios for the acute evaluation were below one, no further assessment was needed.

c. FACT SHEET

A copy of the fact sheet submitted to AEC is included as Appendix E. The fact sheet uses the results from this study to address health concerns related to inhalation of violet-colored M18 air emissions.

7. UNCERTAINTY DISCUSSION

The limitations inherent in modeling and the added conservatism of the evaluation contribute to the uncertainty of the study results. The risk assessment methodology typically includes safety factors that are embedded in the toxicity data to ensure adequate protection of the general population, particularly, susceptible individuals such as the sick, elderly, and children. Table 7 identifies areas of uncertainty associated with this assessment.

TABLE 7: TYPES OF UNCERTAINTY

| Issue | Uncertainty | Direction of Effect |
|---|---|---------------------|
| Modeling | | |
| Modeled versus real-time sampling | The air concentrations in this study were modeled. Actual air concentrations taken from the field may be higher or lower. | Varies |
| Frequency of use for the violet-colored M18 | Actual frequency of use of violet-colored M18s during a training event may be different from those stated in this report. | Varies |
| Hypothetical resident assumed to be located directly downwind | Unless the area around the training facility is populated, the chances that a person living directly downwind is low. | Overestimates |
| Use of worst-case meteorological conditions | To ensure that this study is applicable to most training areas, worst-case meteorological conditions were used in the air model. | Overestimates |
| Exposure Assessment | | |
| Estimating time-averaged concentrations | Actual exposure from the violet-colored M18 is intermittent. If one were to plot a person's exposure profile, the plot would consist of a series of spikes. Since current risk assessment methodology does not allow the evaluation of the potential for health risks as a function of time, a single concentration, averaged over the exposure duration was used. In this study, the exposure durations used were 30 years and 1-hour or 15 minutes. | Varies |
| Chromium speciation | All chromium was assumed to be present as Cr(VI), which is more toxic than Cr(III). | Overestimates |

TABLE 7: TYPES OF UNCERTAINTY

| Issue | Uncertainty | Direction of Effect |
|---|--|----------------------------|
| Comparing estimated concentration to established screening levels | The Region 3 and Region 9 HBSLs were developed using different exposure assumptions than those in this study, resulting in more conservative screening levels. | Overestimates |
| Screening assessment versus calculating an average daily intake | Calculating an average daily intake allows the use of scenario-specific assumptions. However, unless the ratio of concentration to screening level approaches one, a screening assessment is useful as a first-cut evaluation. | Varies |
| Exposure to other munitions | Other munitions are typically used during the same training event. These items may contain similar or different substances from those detected in the violet-colored M18. | Underestimates |
| Toxicity Assessment | | |
| Lack of toxicity data | Some substances were not quantitatively evaluated because they have no known toxicity data. | Underestimates |
| Modifying and uncertainty factors for toxicity data | Modifying factors and uncertainty factors of varying degree are typically applied to toxicological values. These factors are used to conservatively account for extrapolating from animal studies for human health evaluation, and to conservatively account for variation in human populations. | Overestimates |

8. CONCLUSION

Results indicated that residents who live as close as 100 meters directly downwind from training areas are safe from breathing air emissions from the violet-colored M18. It is believed that the assumptions contained in this analysis are conservative enough to be protective of all the population including the sick, elderly, and children.

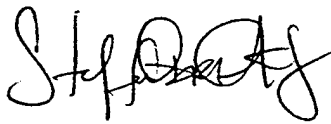
9. RECOMMENDATIONS

Since the results from this study are intended for a hypothetical training facility, they can vary depending on site-specific conditions. However, because of the conservative assumptions used (e.g., worst-case meteorological conditions, receptor located directly downwind, etc.), it is believed that most site-specific analyses would result in even lower concentrations. Therefore, the results from this evaluation should be applicable to most training facilities unless site-specific conditions vary significantly.

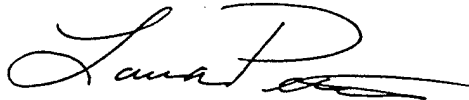
10. POINT OF CONTACT

Questions about this report may be directed to Ms. Laura L. Peters at (800) 222-9698 (ext 2953) or (410) 436-2953.

PREPARED BY:



STAFFORD D.R.F. COAKLEY
Environmental Engineer
Environmental Health Risk Assessment
and Risk Communication Program



LAURA L. PETERS
Environmental Engineer
Environmental Health Risk Assessment
and Risk Communication Program

APPROVED BY:



DAVID L. DAUGHDRILL
Program Manager
Environmental Health Risk Assessment
and Risk Communication

APPENDIX A
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APPENDIX B

AIR DISPERSION MODELING OUTPUT DATA

Table B-1: Air Modeling Output Data for Metals, Particulates, and Miscellaneous Compounds

| Compound | Violet Smoke Grenade NEW, lb = 0.72 | | | | | Number of Items (I): | | 1 Item | |
|-----------------------------------|--|--|--|--|--|--------------------------|--|---------------------------|--|
| | Number of Items = 1 | | | | | Release duration (t): | | 120 seconds | |
| | | | | | | Unit Concentration (UC): | | 3.51E-03 g/m ³ | |
| | Measured Actual Concentration (mg/m ³) | Measured Background Concentration (mg/m ³) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted Per Item (grams) | M | Average Modeled Concentration for One Item (grams/m ³) | CONC | Pollutant Emission Rate for One Item (g/sec) |
| Particulate | | | | | | | | | ER ₁ |
| TSP | 2.673E+03 | 9.029E+00 | 1.623E-01 | 1.169E-01 | 5.302E+01 | | 1.551E-03 | | 4.418E-01 |
| HCl/Cl ₂ | | | | | | | | | |
| HCl (a) | 2.885E-02 | 7.638E-02 | ND | ND | ND | | ND | | ND |
| Cl ₂ (a) | 9.392E-02 | 5.654E-02 | 2.278E-06 | 1.640E-06 | 7.440E-04 | | 2.176E-08 | | 6.200E-06 |
| Dioxin/Furan | | | | | | | | | |
| Dioxin TEQ (c) | 2.726E-07 | ND | 1.661E-11 | 1.196E-11 | 5.425E-09 | | 1.587E-13 | | 4.520E-11 |
| CEM System | | | | | | | | | |
| Carbon Monoxide (CO) | 3.084E+02 | -6.290E-01 | 1.887E-02 | 1.359E-02 | 6.162E+00 | | 1.803E-04 | | 5.135E-02 |
| Nitrogen Oxide (NOx) | 1.118E+01 | 3.827E-02 | 6.801E-04 | 4.897E-04 | 2.221E-01 | | 6.497E-06 | | 1.851E-03 |
| HCl (a) | 1.108E+00 | 4.493E-02 | 6.493E-05 | 4.675E-05 | 2.121E-02 | | 6.203E-07 | | 1.767E-04 |
| Carbon Dioxide (CO ₂) | 1.680E+03 | 7.017E+02 | 5.975E-02 | 4.302E-02 | 1.951E+01 | | 5.709E-04 | | 1.626E-01 |
| Sulfur Dioxide (SO ₂) | 3.718E+00 | 4.739E-03 | 2.267E-04 | 1.633E-04 | 7.405E-02 | | 2.166E-06 | | 6.171E-04 |
| Particulate-phase Metals | | | | | | | | | |
| Aluminum | 9.569E-01 | NM (b) | 5.831E-05 | 4.198E-05 | 1.904E-02 | | 5.571E-07 | | 1.587E-04 |
| Antimony | ND | NM (b) | ND | ND | ND | | ND | | ND |
| Arsenic | ND | NM (b) | ND | ND | ND | | ND | | ND |
| Barium | 1.646E-02 | NM (b) | 1.003E-06 | 7.224E-07 | 3.277E-04 | | 9.586E-09 | | 2.731E-06 |
| Beryllium | ND | NM (b) | ND | ND | ND | | ND | | ND |
| Cadmium | ND | NM (b) | ND | ND | ND | | ND | | ND |
| Chromium | 6.949E-03 | NM (b) | 4.235E-07 | 3.049E-07 | 1.383E-04 | | 4.046E-09 | | 1.153E-06 |
| Cobalt | ND | NM (b) | ND | ND | ND | | ND | | ND |
| Copper | ND | NM (b) | ND | ND | ND | | ND | | ND |
| Lead | 3.662E-01 | NM (b) | 2.232E-05 | 1.607E-05 | 7.288E-03 | | 2.132E-07 | | 6.073E-05 |
| Magnesium | 1.310E-01 | NM (b) | 7.981E-06 | 5.747E-06 | 2.607E-03 | | 7.625E-08 | | 2.172E-05 |
| Manganese | 2.411E-02 | NM (b) | 1.469E-06 | 1.058E-06 | 4.798E-04 | | 1.404E-08 | | 3.999E-06 |

Table B-1: Air Modeling Output Data for Metals, Particulates, and Miscellaneous Compounds

| Compound | Violet Smoke Grenade | | | | | Number of Items (I): | | 1 item | |
|------------|--|--|--|--|--|--|--|---------------------------|--|
| | NEW, lb = 0.72 | | | | | Release duration (I): | | 120 seconds | |
| | Number of Items = 1 | | | | | Unit Concentration (UC): | | 3.51E-03 g/m ³ | |
| | Measured Actual Concentration (mg/m ³) | Measured Background Concentration (mg/m ³) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted Per Item (grams) | Average Modeled Concentration for One Item (grams/m ³) | Pollutant Emission Rate for One Item (g/sec) | ER ₁ | |
| Nickel | 4.784E-03 | NM (b) | 2.916E-07 | 2.099E-07 | 9.522E-05 | 2.785E-09 | 7.935E-07 | 7.935E-07 | |
| Phosphorus | ND | NM (b) | ND | ND | ND | ND | ND | ND | |
| Selenium | ND | NM (b) | ND | ND | ND | ND | ND | ND | |
| Silver | ND | NM (b) | ND | ND | ND | ND | ND | ND | |
| Thallium | ND | NM (b) | ND | ND | ND | ND | ND | ND | |
| Zinc | 4.918E-02 | NM (b) | 2.997E-06 | 2.158E-06 | 9.788E-04 | 2.863E-08 | 8.157E-06 | 8.157E-06 | |
| Mercury | 2.806E-04 | NM (b) | 1.710E-08 | 1.231E-08 | 5.586E-06 | 1.634E-10 | 4.655E-08 | 4.655E-08 | |

Footnotes:

ND = Not Detected
 NEW = Net Explosive Weight
 NM = Not Measureable
 CEM = Continuous Emissions Monitoring
 (a) HCl/Cl₂ levels were too low to be reliably measured (except for White Smoke)
 (b) Insufficient material to analyze.
 (c) Presence questionable - reported at similar levels in samples and blanks.

Table B-2: Air Modeling Output Data for Volatile Organic Compounds

| Compound | Violet Smoke Grenade NEW, lb = 0.72 Number of Items = 1 | | | | | Number of Items (I): Release duration (I): Unit Concentration (UC): | | 1 item 120 seconds 3.51E-03 g/m ³ | |
|---------------------------------------|---|---|---|---|--|---|--|--|--|
| | Measured Actual Concentration (mg/m ³) | Measured Background Concentration (mg/m ³) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted Per Item (grams) | M _i | Average Modeled Concentration for One Item (grams/m ³) CONC | Pollutant Emission Rate for One Item (g/sec) ER _i | |
| | | | | | | | | | |
| | | | | | | | | | |
| Total Nonmethane Hydrocarbons (TNMHC) | 2.433E+01 | 2.227E-01 | 1.565E-03 | 1.127E-03 | 5.112E-01 | | 1.496E-05 | 4.260E-03 | |
| TNMHC | | | | | | | | | |
| Volatile Organic Compounds (VOCs) | | | | | | | | | |
| Ethane | 2.465E-01 | 2.200E-03 | 1.586E-05 | 1.142E-05 | 5.180E-03 | | 1.515E-07 | 4.317E-05 | |
| Ethylene | 6.512E+00 | 4.000E-04 | 4.228E-04 | 3.044E-04 | 1.381E-01 | | 4.039E-06 | 1.151E-03 | |
| Acetylene | 3.378E+00 | 7.000E-04 | 2.192E-04 | 1.579E-04 | 7.160E-02 | | 2.095E-06 | 5.967E-04 | |
| Propane | 7.250E-02 | 1.700E-03 | 4.597E-06 | 3.310E-06 | 1.501E-03 | | 4.392E-08 | 1.251E-05 | |
| Propene | 9.265E-01 | 2.000E-04 | 6.014E-05 | 4.330E-05 | 1.964E-02 | | 5.746E-07 | 1.637E-04 | |
| i-Butane | 5.500E-03 | 1.000E-03 | 2.922E-07 | 2.104E-07 | 9.542E-05 | | 2.791E-09 | 7.952E-07 | |
| i-Butene | 9.450E-02 | ND | 6.136E-06 | 4.418E-06 | 2.004E-03 | | 5.862E-08 | 1.670E-05 | |
| 1-Butene | 2.220E-01 | ND | 1.441E-05 | 1.038E-05 | 4.707E-03 | | 1.377E-07 | 3.923E-05 | |
| 1,3-Butadiene | 2.575E-01 | ND | 1.672E-05 | 1.204E-05 | 5.460E-03 | | 1.597E-07 | 4.550E-05 | |
| n-Butane | 2.450E-02 | 2.000E-03 | 1.461E-06 | 1.052E-06 | 4.771E-04 | | 1.396E-08 | 3.976E-06 | |
| trans-2-Butene | 1.550E-01 | ND | 1.006E-05 | 7.246E-06 | 3.287E-03 | | 9.615E-08 | 2.739E-05 | |
| 2,2-Dimethylpropane | ND | ND | ND | ND | ND | | ND | ND | |
| cis-2-Butene | 2.800E-02 | ND | 1.818E-06 | 1.309E-06 | 5.937E-04 | | 1.737E-08 | 4.948E-06 | |
| 3-Methyl-1-butene | 1.850E-02 | ND | 1.201E-06 | 8.648E-07 | 3.923E-04 | | 1.148E-08 | 3.269E-06 | |
| i-Pentane | ND | 1.300E-03 | ND | ND | ND | | ND | ND | |
| 1-Pentene | 1.075E-01 | ND | 6.980E-06 | 5.025E-06 | 2.279E-03 | | 6.668E-08 | 1.900E-05 | |
| 2-Methyl-1-butene | 2.600E-02 | ND | 1.688E-06 | 1.215E-06 | 5.513E-04 | | 1.613E-08 | 4.594E-06 | |
| n-Pentane | ND | 8.000E-04 | ND | ND | ND | | ND | ND | |
| Isoprene | ND | 2.000E-04 | ND | ND | ND | | ND | ND | |
| trans-2-Pentene | ND | ND | ND | ND | ND | | ND | ND | |
| cis-2-Pentene | ND | ND | ND | ND | ND | | ND | ND | |
| 2-Methyl-2-butene | ND | ND | ND | ND | ND | | ND | ND | |
| 2,2-Dimethylbutane | ND | 1.000E-04 | ND | ND | ND | | ND | ND | |
| Cyclopentene | ND | ND | ND | ND | ND | | ND | ND | |
| 4-Methyl-1-pentene | ND | ND | ND | ND | ND | | ND | ND | |
| Cyclopentane | ND | 1.000E-04 | ND | ND | ND | | ND | ND | |
| 2,3-Dimethylbutane | ND | 2.000E-04 | ND | ND | ND | | ND | ND | |
| cis-4-Methyl-2-pentene | ND | ND | ND | ND | ND | | ND | ND | |
| 2-Methylpentane | ND | 9.000E-04 | ND | ND | ND | | ND | ND | |
| 3-Methylpentane | ND | 4.000E-04 | ND | ND | ND | | ND | ND | |

Table B-2: Air Modeling Output Data for Volatile Organic Compounds

| Compound | Measured Actual Concentration (mg/m ³) | Measured Background Concentration (mg/m ³) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted Per Item (grams) | Average Modeled Concentration for One Item (grams/m ³) | Pollutant Emission Rate for One Item (g/sec) |
|---------------------------|--|--|--|--|--|--|--|
| 2-Methyl-1-pentene | ND | ND | ND | ND | ND | ND | ND |
| 1-Hexene | 1.530E-01 | ND | 9.934E-06 | 7.152E-06 | 3.244E-03 | 9.491E-08 | 2.704E-05 |
| n-Hexane | ND | 9.000E-04 | ND | ND | ND | ND | ND |
| trans-2-Hexene | ND | ND | ND | ND | ND | ND | ND |
| 2-Methyl-2-pentene | ND | ND | ND | ND | ND | ND | ND |
| cis-2-Hexene | ND | ND | ND | ND | ND | ND | ND |
| Methylcyclopentane | ND | 4.000E-04 | ND | ND | ND | ND | ND |
| 2,4-Dimethylpentane | ND | 1.000E-04 | ND | ND | ND | ND | ND |
| Benzene | 1.712E+00 | 1.000E-03 | 1.111E-04 | 7.986E-05 | 3.627E-02 | 1.061E-06 | 3.023E-04 |
| Cyclohexane | ND | 2.000E-04 | ND | ND | ND | ND | ND |
| 2-Methylhexane | ND | 3.000E-04 | ND | ND | ND | ND | ND |
| 2,3-Dimethylpentane | ND | 2.000E-04 | ND | ND | ND | ND | ND |
| 3-Methylhexane | ND | 4.000E-04 | ND | ND | ND | ND | ND |
| 2,2,4-Trimethylpentane | ND | 5.000E-04 | ND | ND | ND | ND | ND |
| n-Heptane | ND | 4.000E-04 | ND | ND | ND | ND | ND |
| 2,4,4-Trimethyl-1-pentene | ND | ND | ND | ND | ND | ND | ND |
| Methylcyclohexane | ND | 4.000E-04 | ND | ND | ND | ND | ND |
| 2,4,4-Trimethyl-2-pentene | ND | ND | ND | ND | ND | ND | ND |
| 2,5-Dimethylhexane | ND | 1.000E-04 | ND | ND | ND | ND | ND |
| 2,4-Dimethylhexane | ND | 1.000E-04 | ND | ND | ND | ND | ND |
| 2,3,4-Trimethylpentane | ND | 2.000E-04 | ND | ND | ND | ND | ND |
| Toluene | 1.980E-01 | 2.200E-03 | 1.271E-05 | 9.153E-06 | 4.152E-03 | 1.215E-07 | 3.460E-05 |
| 2,3-Dimethylhexane | ND | ND | ND | ND | ND | ND | ND |
| 2-Methylheptane | ND | 1.000E-04 | ND | ND | ND | ND | ND |
| 3-Ethylhexane | ND | 1.000E-04 | ND | ND | ND | ND | ND |
| 2,2-Dimethylheptane | ND | ND | ND | ND | ND | ND | ND |
| 2,2,4-Trimethylhexane | ND | ND | ND | ND | ND | ND | ND |
| n-Octane | ND | 1.000E-04 | ND | ND | ND | ND | ND |
| Ethylcyclohexane | ND | ND | ND | ND | ND | ND | ND |
| Ethylbenzene | 2.400E-02 | 9.700E-03 | 9.285E-07 | 6.685E-07 | 3.032E-04 | 8.870E-09 | 2.527E-06 |
| m-Xylene & p-Xylene | 5.750E-02 | 3.930E-02 | 1.182E-06 | 8.508E-07 | 3.859E-04 | 1.129E-08 | 3.216E-06 |
| Styrene | ND | ND | ND | ND | ND | ND | ND |
| o-Xylene | 3.300E-02 | 1.340E-02 | 1.273E-06 | 9.163E-07 | 4.156E-04 | 1.216E-08 | 3.463E-06 |
| n-Nonane | ND | ND | ND | ND | ND | ND | ND |
| i-Propylbenzene | ND | ND | ND | ND | ND | ND | ND |
| n-Propylbenzene | ND | 1.000E-04 | ND | ND | ND | ND | ND |
| p-Ethyltoluene | ND | 3.000E-04 | ND | ND | ND | ND | ND |

Table B-2: Air Modeling Output Data for Volatile Organic Compounds

| Compound | Measured Actual Concentration (mg/m ³) | Measured Background Concentration (mg/m ³) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted Per Item (grams) | Average Modeled Concentration for One Item (grams/m ³) CONC | Pollutant Emission Rate for One Item (g/sec) ER _i |
|---|--|--|--|--|--|---|--|
| m-Ethyltoluene | ND | 1.000E-04 | ND | ND | ND | ND | ND |
| 1,3,5-Trimethylbenzene | ND | 1.000E-04 | ND | ND | ND | ND | ND |
| o-Ethyltoluene | ND | ND | ND | ND | ND | ND | ND |
| 1,2,4-Trimethylbenzene & sec-Butylbenzene | ND | 2.000E-04 | ND | ND | ND | ND | ND |
| n-Decane | ND | ND | ND | ND | ND | ND | ND |
| alpha-Pinene | ND | ND | ND | ND | ND | ND | ND |
| beta-Pinene | ND | ND | ND | ND | ND | ND | ND |
| delta 3-Carene | ND | ND | ND | ND | ND | ND | ND |
| d-Limonene | ND | ND | ND | ND | ND | ND | ND |
| MTBE | ND | 2.000E-04 | ND | ND | ND | ND | ND |
| Dichlorodifluoromethane | 5.543E-03 | 4.513E-03 | 6.684E-08 | 4.813E-08 | 2.183E-05 | 6.386E-10 | 1.819E-07 |
| Methylchloride | ND | ND | ND | ND | ND | ND | ND |
| Dichlorotetrafluoroethane | ND | ND | ND | ND | ND | ND | ND |
| Chloroethene | 5.803E-02 | ND | 3.768E-06 | 2.713E-06 | 1.231E-03 | 3.600E-08 | 1.025E-05 |
| 1,3-Butadiene | 2.619E-01 | ND | 1.701E-05 | 1.224E-05 | 5.554E-03 | 1.625E-07 | 4.628E-05 |
| Methylbromide | ND | ND | ND | ND | ND | ND | ND |
| Ethylchloride | 4.370E-03 | ND | 2.837E-07 | 2.043E-07 | 9.266E-05 | 2.710E-09 | 7.721E-07 |
| Trichloromonofluoromethane | 2.045E-03 | 2.448E-03 | ND | ND | ND | ND | ND |
| Vinylidenechloride | 5.193E-03 | ND | 3.372E-07 | 2.428E-07 | 1.101E-04 | 3.221E-09 | 9.176E-07 |
| Methylenechloride | 4.851E-02 | 6.266E-03 | 2.743E-06 | 1.975E-06 | 8.958E-04 | 2.620E-08 | 7.465E-06 |
| Allylchloride | ND | ND | ND | ND | ND | ND | ND |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | ND | 7.924E-04 | ND | ND | ND | ND | ND |
| 1,1-Dichloroethane | ND | ND | ND | ND | ND | ND | ND |
| 1,2-Dichloroethene | ND | ND | ND | ND | ND | ND | ND |
| Chloroform | 8.944E-02 | ND | 5.807E-06 | 4.181E-06 | 1.897E-03 | 5.548E-08 | 1.580E-05 |
| 1,2-Dichloroethane | ND | ND | ND | ND | ND | ND | ND |
| Methylchloroform | ND | 2.911E-04 | ND | ND | ND | ND | ND |
| Benzene | 1.741E-00 | 1.017E-03 | 1.130E-04 | 8.133E-05 | 3.689E-02 | 1.079E-06 | 3.074E-04 |
| Carbontetrachloride | 2.461E-02 | 1.587E-03 | 1.495E-06 | 1.076E-06 | 4.883E-04 | 1.428E-08 | 4.069E-06 |
| 1,2-Dichloropropane | ND | ND | ND | ND | ND | ND | ND |
| Trichloroethylene | 2.279E-03 | ND | 1.480E-07 | 1.065E-07 | 4.832E-05 | 1.414E-09 | 4.027E-07 |
| cis 1,3-Dichloro-1-propene | ND | ND | ND | ND | ND | ND | ND |
| trans 1,3-Dichloro-1-propene | ND | ND | ND | ND | ND | ND | ND |
| 1,1,2-Trichloroethane | ND | ND | ND | ND | ND | ND | ND |
| Toluene | 2.014E-01 | 2.238E-03 | 1.293E-05 | 9.310E-06 | 4.223E-03 | 1.235E-07 | 3.519E-05 |
| 1,2-Dibromoethane | ND | ND | ND | ND | ND | ND | ND |
| Perchloroethylene | 8.357E-02 | 1.547E-03 | 5.325E-06 | 3.834E-06 | 1.739E-03 | 5.088E-08 | 1.449E-05 |

Table B-2: Air Modeling Output Data for Volatile Organic Compounds

| Compound | Measured Actual Concentration (mg/m ³) | Measured Background Concentration (mg/m ³) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted Per Item (grams) | Average Modeled Concentration for One Item (grams/m ³) | Pollutant Emission Rate for One Item (g/sec) |
|---------------------------|--|--|--|--|--|--|--|
| Chlorobenzene | 5.060E-02 | ND | 3.286E-06 | 2.366E-06 | 1.073E-03 | 3.139E-08 | 8.942E-06 |
| Ethylbenzene | 3.685E-02 | 1.489E-02 | 1.425E-06 | 1.026E-06 | 4.655E-04 | 1.362E-08 | 3.879E-06 |
| m&p-Xylene | 5.848E-02 | 3.957E-02 | 1.202E-06 | 8.654E-07 | 3.925E-04 | 1.148E-08 | 3.271E-06 |
| Styrene | ND | ND | ND | ND | ND | ND | ND |
| 1,1,2,2-Tetrachloroethane | ND | ND | ND | ND | ND | ND | ND |
| o-Xylene | 3.358E-02 | 1.363E-02 | 1.294E-06 | 9.319E-07 | 4.227E-04 | 1.237E-08 | 3.523E-06 |
| p-Ethyltoluene | ND | 3.051E-04 | ND | ND | ND | ND | ND |
| 1,3,5-Trimethylbenzene | ND | ND | ND | ND | ND | ND | ND |
| 1,2,4-Trimethylbenzene | ND | ND | ND | ND | ND | ND | ND |
| Benzylchloride | ND | ND | ND | ND | ND | ND | ND |
| m-Dichlorobenzene | 2.277E-03 | ND | 1.479E-07 | 1.065E-07 | 4.829E-05 | 1.413E-09 | 4.024E-07 |
| p-Dichlorobenzene | 1.582E-03 | ND | 1.027E-07 | 7.396E-08 | 3.355E-05 | 9.814E-10 | 2.796E-07 |
| o-Dichlorobenzene | 1.780E-02 | ND | 1.156E-06 | 8.323E-07 | 3.775E-04 | 1.104E-08 | 3.146E-06 |
| 1,2,4-Trichlorobenzene | ND | ND | ND | ND | ND | ND | ND |
| Hexachlorobutadiene | 1.013E-01 | 8.440E-04 | 6.524E-06 | 4.697E-06 | 2.131E-03 | 6.233E-08 | 1.776E-05 |
| Phenylacetylene | 7.842E-02 | ND | 5.092E-06 | 3.666E-06 | 1.663E-03 | 4.864E-08 | 1.386E-05 |
| d-Limonene | ND | 7.720E-04 | ND | ND | ND | ND | ND |
| Methylnitrite | 1.410E-02 | ND | 9.156E-07 | 6.593E-07 | 2.990E-04 | 8.748E-09 | 2.492E-06 |
| Acetonitrile | 5.942E-01 | ND | 3.858E-05 | 2.778E-05 | 1.260E-02 | 3.686E-07 | 1.050E-04 |
| Acrylonitrile | 7.684E-01 | ND | 4.989E-05 | 3.592E-05 | 1.629E-02 | 4.767E-07 | 1.358E-04 |
| Nitromethane | ND | ND | ND | ND | ND | ND | ND |
| Benzonitrile | 9.463E-01 | 1.575E-04 | 6.143E-05 | 4.423E-05 | 2.006E-02 | 5.869E-07 | 1.672E-04 |
| Nitrobenzene | ND | ND | ND | ND | ND | ND | ND |
| 4-Methylbenzonitrile | ND | ND | ND | ND | ND | ND | ND |
| Carbon Disulfide | 3.613E+00 | 1.842E-04 | 2.346E-04 | 1.689E-04 | 7.662E-02 | 2.241E-06 | 6.385E-04 |
| Thiophene | 1.058E+00 | ND | 6.868E-05 | 4.945E-05 | 2.243E-02 | 6.562E-07 | 1.869E-04 |
| Dimethyldisulfide | 8.322E-02 | ND | 5.403E-06 | 3.891E-06 | 1.765E-03 | 5.162E-08 | 1.471E-05 |
| 2-Methylthiophene | 5.968E-02 | ND | 3.875E-06 | 2.790E-06 | 1.266E-03 | 3.702E-08 | 1.055E-05 |
| 3-Methylthiophene | 5.182E-02 | ND | 3.365E-06 | 2.423E-06 | 1.099E-03 | 3.215E-08 | 9.158E-06 |
| Dimethyltrisulfide | 2.155E-01 | ND | 1.399E-05 | 1.007E-05 | 4.569E-03 | 1.337E-07 | 3.808E-05 |
| 1-Chlorobutane | ND | ND | ND | ND | ND | ND | ND |
| 1-Bromo-2-chloroethane | ND | ND | ND | ND | ND | ND | ND |
| 2-Bromo-1-chloropropane | ND | ND | ND | ND | ND | ND | ND |
| 1,2-Dichlorobutane | ND | ND | ND | ND | ND | ND | ND |
| 1,2,3-Trichloropropane | ND | ND | ND | ND | ND | ND | ND |
| 1-Chloro-2-methylbenzene | ND | ND | ND | ND | ND | ND | ND |
| 1-Chloro-3-methylbenzene | ND | ND | ND | ND | ND | ND | ND |

Table B-2: Air Modeling Output Data for Volatile Organic Compounds

| Compound | Measured Actual Concentration (mg/m ³) | Measured Background Concentration (mg/m ³) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted Per Item (grams) | Average Modeled Concentration for One Item (grams/m ³) | Pollutant Emission Rate for One Item (g/sec) |
|------------------------------|--|--|--|--|--|--|--|
| 1-Chloro-4-ethylbenzene | ND | ND | ND | ND | ND | ND | ND |
| Pentachloro-1-propene | ND | ND | ND | ND | ND | ND | ND |
| Hexachloroethane | 1.092E-01 | ND | 7.091E-06 | 5.108E-06 | 2.316E-03 | 6.775E-08 | 1.930E-05 |
| 1,2-Dichloro-3-methylbenzene | 1.134E-02 | ND | 7.362E-07 | 5.301E-07 | 2.404E-04 | 7.033E-09 | 2.004E-06 |
| Carbonyl Sulfide | 3.176E-01 | ND | 2.062E-05 | 1.485E-05 | 6.735E-03 | 1.970E-07 | 5.612E-05 |
| Trichloroacetonitrile | ND | ND | ND | ND | ND | ND | ND |
| Dichloroacetonitrile | 1.214E-02 | ND | 7.882E-07 | 5.675E-07 | 2.574E-04 | 7.531E-09 | 2.145E-06 |
| Isothiocyanatomethane | ND | ND | ND | ND | ND | ND | ND |
| 1,1-Dichloro-2-propanone | ND | ND | ND | ND | ND | ND | ND |
| 2-Thiophenecarboxaldehyde | 1.072E-01 | ND | 6.961E-06 | 5.012E-06 | 2.274E-03 | 6.651E-08 | 1.895E-05 |
| Acetaldehyde | 1.706E+00 | ND | 1.107E-04 | 7.974E-05 | 3.617E-02 | 1.058E-06 | 3.014E-04 |
| Ethanol | 2.174E-02 | 9.259E-04 | 1.351E-06 | 9.730E-07 | 4.413E-04 | 1.291E-08 | 3.678E-06 |
| Acrolein | 6.539E-02 | ND | 4.245E-06 | 3.057E-06 | 1.386E-03 | 4.056E-08 | 1.155E-05 |
| Acetone | 4.080E+00 | 3.013E-02 | 2.629E-04 | 1.893E-04 | 8.586E-02 | 2.512E-06 | 7.155E-04 |
| Propanal | 3.005E-02 | ND | 1.951E-06 | 1.405E-06 | 6.372E-04 | 1.864E-08 | 5.310E-06 |
| Furan | 2.925E-01 | ND | 1.899E-05 | 1.368E-05 | 6.203E-03 | 1.815E-07 | 5.169E-05 |
| 2-Propanol | 8.107E-03 | 4.633E-03 | 2.256E-07 | 1.624E-07 | 7.368E-05 | 2.155E-09 | 6.140E-07 |
| Methacrolein | 6.724E-02 | ND | 4.366E-06 | 3.143E-06 | 1.426E-03 | 4.171E-08 | 1.188E-05 |
| MTBE | ND | 4.864E-04 | ND | ND | ND | ND | ND |
| Methyl-vinyl ketone | 5.390E-02 | ND | 3.499E-06 | 2.520E-06 | 1.143E-03 | 3.343E-08 | 9.524E-06 |
| 2,3-Butanedione | 2.196E-01 | ND | 1.426E-05 | 1.026E-05 | 4.656E-03 | 1.362E-07 | 3.880E-05 |
| Butanal | 2.223E-02 | 7.534E-04 | 1.395E-06 | 1.004E-06 | 4.555E-04 | 1.332E-08 | 3.796E-06 |
| 2-Butanone | 2.026E-01 | 6.780E-03 | 1.271E-05 | 9.153E-06 | 4.152E-03 | 1.215E-07 | 3.460E-05 |
| 2-Methylfuran | 6.257E-02 | ND | 4.062E-06 | 2.925E-06 | 1.327E-03 | 3.881E-08 | 1.108E-05 |
| 3-Methylfuran | 1.072E-02 | ND | 6.961E-07 | 5.012E-07 | 2.273E-04 | 6.650E-09 | 1.894E-06 |
| trans-2-Butenal | 1.646E-01 | ND | 1.069E-05 | 7.695E-06 | 3.491E-03 | 1.021E-07 | 2.909E-05 |
| Tetrahydrofuran | ND | 1.496E-03 | ND | ND | ND | ND | ND |
| 3-Methyl-2-butanone | ND | ND | ND | ND | ND | ND | ND |
| Acetic Acid | 8.660E-02 | 2.891E-04 | 5.604E-06 | 4.035E-06 | 1.830E-03 | 5.354E-08 | 1.525E-05 |
| 1-Butanol | ND | ND | ND | ND | ND | ND | ND |
| 1-Penten-3-one | ND | ND | ND | ND | ND | ND | ND |
| 2-Pentanone | ND | ND | ND | ND | ND | ND | ND |
| Pentanal | ND | ND | ND | ND | ND | ND | ND |
| 2,3-Pentanedione | ND | ND | ND | ND | ND | ND | ND |
| 1,2-Dichloro-2-methylpropane | ND | ND | ND | ND | ND | ND | ND |
| 3-Pentanone | ND | ND | ND | ND | ND | ND | ND |
| 2,5-Dimethylfuran | 1.089E-02 | ND | 6.942E-07 | 4.998E-07 | 2.267E-04 | 6.632E-09 | 1.889E-06 |

Table B-2: Air Modeling Output Data for Volatile Organic Compounds

| Compound | Measured Actual Concentration (mg/m ³) | Measured Background Concentration (mg/m ³) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted Per Item (grams) | Average Modeled Concentration for One Item (grams/m ³) | Pollutant Emission Rate for One Item (g/sec) |
|------------------------|--|--|--|--|--|--|--|
| 4-Methyl-2-pentanone | ND | ND | ND | ND | ND | ND | ER ₁ |
| trans-3-Penten-2-one | 2.019E-02 | ND | 1.311E-06 | 9.440E-07 | 4.282E-04 | 1.253E-08 | 3.568E-06 |
| Cyclopentanone | ND | ND | ND | ND | ND | ND | ND |
| 2-Hexanone | ND | ND | ND | ND | ND | ND | ND |
| Hexanal | 4.278E-02 | 5.669E-04 | 2.741E-06 | 1.973E-06 | 8.951E-04 | 2.619E-08 | 7.459E-06 |
| 3-Furaldehyde | 2.100E-01 | ND | 1.363E-05 | 9.817E-06 | 4.453E-03 | 1.303E-07 | 3.711E-05 |
| 2-Cyclopenten-1-one | ND | ND | ND | ND | ND | ND | ND |
| 2-Furaldehyde | 5.190E-01 | 3.280E-04 | 3.368E-05 | 2.425E-05 | 1.100E-02 | 3.217E-07 | 9.165E-05 |
| 1-Acetoxyacetone | ND | ND | ND | ND | ND | ND | ND |
| 2-Heptanone | ND | ND | ND | ND | ND | ND | ND |
| Heptanal | ND | 5.167E-04 | ND | ND | ND | ND | ND |
| 5-Methyl-2-furaldehyde | ND | ND | ND | ND | ND | ND | ND |
| Benzaldehyde | 1.558E-01 | 8.465E-04 | 1.006E-05 | 7.243E-06 | 3.285E-03 | 9.611E-08 | 2.738E-05 |
| Benzofuran | 5.155E-02 | ND | 3.347E-06 | 2.410E-06 | 1.093E-03 | 3.198E-08 | 9.110E-06 |
| Octanal | 2.582E-02 | 7.992E-04 | 1.624E-06 | 1.170E-06 | 5.305E-04 | 1.552E-08 | 4.421E-06 |
| Acetophenone | ND | ND | ND | ND | ND | ND | ND |
| 2-Nonanone | ND | 5.743E-04 | ND | ND | ND | ND | ND |
| Nonanal | ND | 7.963E-04 | ND | ND | ND | ND | ND |

Footnotes:

ND = Not Detected

NEW = Net Explosive Weight

Items in bold represent duplicate values for those compounds that are common for Method TO-14 and TO-12.

Table B-3: Air Modeling Output Data for Semi-Volatile Organic Compounds

| Compound | Violet Smoke Grenade | | | | | Number of Items (I): | | 1 item |
|-------------------------------|--|--|--|--|--|--------------------------|--|--|
| | NEW, lb = 0.72 | | | | | Release duration (I): | | 120 seconds |
| | Number of Items = 1 | | | | | Unit Concentration (UC): | | 3.51E-03 g/m ³ |
| | Measured Actual Concentration (mg/m ³) | Measured Background Concentration (mg/m ³) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted Per Item (grams) | M | Average Modeled Concentration for One Item (grams/m ³) CONC. | Pollutant Emission Rate for One Item (grams/sec) ER ₁ |
| Particulate/Vapor-phase SVOCs | | | | | | | | |
| N-Nitrosodimethylamine | ND | ND | ND | ND | ND | ND | ND | ND |
| Pyridine | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Picoline | ND | ND | ND | ND | ND | ND | ND | ND |
| Methyl methanesulfonate | ND | ND | ND | ND | ND | ND | ND | ND |
| N-Nitrosomethylethylamine | ND | ND | ND | ND | ND | ND | ND | ND |
| N-Nitrosodiethylamine | ND | ND | ND | ND | ND | ND | ND | ND |
| Ethyl methanesulfonate | ND | ND | ND | ND | ND | ND | ND | ND |
| Phenol | ND | ND | ND | ND | ND | ND | ND | ND |
| Aniline | ND | ND | ND | ND | ND | ND | ND | ND |
| bis(2-Chloroethyl)ether | ND | ND | ND | ND | ND | ND | ND | ND |
| Pentachloroethane | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Chlorophenol | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,3-Dichlorobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,4-Dichlorobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| Benzyl alcohol | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Methylphenol | ND | ND | ND | ND | ND | ND | ND | ND |
| 1,2-Dichlorobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| bis(2-Chloroisopropyl)ether | ND | ND | ND | ND | ND | ND | ND | ND |
| o-Toluidine | ND | ND | ND | ND | ND | ND | ND | ND |
| 4-Methylphenol/3-Methylphenol | ND | ND | ND | ND | ND | ND | ND | ND |
| N-Nitroso-di-n-propylamine | ND | ND | ND | ND | ND | ND | ND | ND |
| Acetophenone | ND | 3.435E-03 | ND | ND | ND | ND | ND | ND |
| N-Nitrosomorpholine | ND | ND | ND | ND | ND | ND | ND | ND |
| N-Nitrosopyrrolidine | ND | ND | ND | ND | ND | ND | ND | ND |
| Hexachloroethane | ND | ND | ND | ND | ND | ND | ND | ND |
| Nitrobenzene | ND | ND | ND | ND | ND | ND | ND | ND |
| N-Nitrosopiperidine | ND | ND | ND | ND | ND | ND | ND | ND |
| Isophorone | ND | ND | ND | ND | ND | ND | ND | ND |
| 2,4-Dimethylphenol | ND | ND | ND | ND | ND | ND | ND | ND |
| 2-Nitrophenol | ND | ND | ND | ND | ND | ND | ND | ND |

Table B-3: Air Modeling Output Data for Semi-Volatile Organic Compounds

| Compound | Measured Actual Concentration (mg/m ³) | Measured Background Concentration (mg/m ³) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted Per Item (grams) | Average Modeled Concentration for One Item (grams/m ³) | Pollutant Emission Rate for One Item (grams/sec) |
|----------------------------|--|--|--|--|--|--|--|
| bis(2-Chloroethoxy)methane | ND | ND | ND | ND | ND | ND | ND |
| Benzoic acid | ND | ND | ND | ND | ND | ND | ND |
| 2,4-Dichlorophenol | ND | ND | ND | ND | ND | ND | ND |
| 1,2,4-Trichlorobenzene | ND | ND | ND | ND | ND | ND | ND |
| Naphthalene | ND | ND | ND | ND | ND | ND | ND |
| p-Chloroaniline | ND | ND | ND | ND | ND | ND | ND |
| 2,6-Dichlorophenol | ND | ND | ND | ND | ND | ND | ND |
| Hexachloropropene | ND | ND | ND | ND | ND | ND | ND |
| Hexachlorobutadiene | ND | ND | ND | ND | ND | ND | ND |
| Dimethylphenethylamine | ND | ND | ND | ND | ND | ND | ND |
| N-Nitroso-di-n-butylamine | ND | ND | ND | ND | ND | ND | ND |
| 4-Chloro-3-methylphenol | ND | ND | ND | ND | ND | ND | ND |
| Safrrole | ND | ND | ND | ND | ND | ND | ND |
| 2-Methylnaphthalene | ND | ND | ND | ND | ND | ND | ND |
| 1,2,4,5-Tetrachlorobenzene | ND | ND | ND | ND | ND | ND | ND |
| Hexachlorocyclopentadiene | ND | ND | ND | ND | ND | ND | ND |
| 2,4,6-Trichlorophenol | ND | ND | ND | ND | ND | ND | ND |
| 2,4,5-Trichlorophenol | ND | ND | ND | ND | ND | ND | ND |
| Isosafrole | ND | ND | ND | ND | ND | ND | ND |
| 2-Chloronaphthalene | ND | ND | ND | ND | ND | ND | ND |
| 2-Nitroaniline | ND | ND | ND | ND | ND | ND | ND |
| 1,4-Naphthoquinone | ND | ND | ND | ND | ND | ND | ND |
| Dimethylphthalate | ND | ND | ND | ND | ND | ND | ND |
| 1,3-Dinitrobenzene | ND | ND | ND | ND | ND | ND | ND |
| 2,6-Dinitrotoluene | ND | ND | ND | ND | ND | ND | ND |
| Acenaphthylene | ND | ND | ND | ND | ND | ND | ND |
| 3-Nitroaniline | ND | ND | ND | ND | ND | ND | ND |
| 4-Nitrophenol | ND | ND | ND | ND | ND | ND | ND |
| 2,4-Dinitrophenol | ND | ND | ND | ND | ND | ND | ND |
| Acenaphthene | ND | ND | ND | ND | ND | ND | ND |
| 2,4-Dinitrotoluene | ND | ND | ND | ND | ND | ND | ND |
| Dibenzofuran | ND | ND | ND | ND | ND | ND | ND |
| Pentachlorobenzene | ND | ND | ND | ND | ND | ND | ND |
| 1-Naphthylamine | ND | ND | ND | ND | ND | ND | ND |

Table B-3: Air Modeling Output Data for Semi-Volatile Organic Compounds

| Compound | Measured Actual Concentration (mg/m ³) | Measured Background Concentration (mg/m ³) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted Per Item (grams) | Average Modeled Concentration for One Item (grams/m ³) | Pollutant Emission Rate for One Item (grams/sec) |
|----------------------------|--|--|--|--|--|--|--|
| 2-Naphthylamine | ND | ND | ND | ND | ND | ND | ND |
| 2,3,4,6-Tetrachlorophenol | ND | ND | ND | ND | ND | ND | ND |
| Diethylphthalate | ND | 1.041E-03 | ND | ND | ND | ND | ND |
| 4-Chlorophenylphenyl ether | ND | ND | ND | ND | ND | ND | ND |
| Fluorene | ND | ND | ND | ND | ND | ND | ND |
| 5-Nitro-o-toluidine | ND | ND | ND | ND | ND | ND | ND |
| 4-Nitroaniline | ND | ND | ND | ND | ND | ND | ND |
| 4,6-Dinitro-2-methylphenol | ND | ND | ND | ND | ND | ND | ND |
| Diphenylamine/N-NitrosoDPA | ND | ND | ND | ND | ND | ND | ND |
| sym-Tritirobenzene | ND | ND | ND | ND | ND | ND | ND |
| Diallylate | ND | ND | ND | ND | ND | ND | ND |
| Phenacetin | ND | ND | ND | ND | ND | ND | ND |
| 4-Bromophenylphenyl ether | ND | ND | ND | ND | ND | ND | ND |
| Hexachlorobenzene | ND | 5.860E-03 | ND | ND | ND | ND | ND |
| 4-Aminobiphenyl | ND | ND | ND | ND | ND | ND | ND |
| Pronamide | ND | ND | ND | ND | ND | ND | ND |
| Pentachlorophenol | ND | ND | ND | ND | ND | ND | ND |
| Pentachloronitrobenzene | ND | ND | ND | ND | ND | ND | ND |
| Phenanthrene | ND | ND | ND | ND | ND | ND | ND |
| Anthracene | ND | ND | ND | ND | ND | ND | ND |
| Carbazole | ND | ND | ND | ND | ND | ND | ND |
| Di-n-butylphthalate | ND | ND | ND | ND | ND | ND | ND |
| 4-Nitroquinoline-1-oxide | ND | ND | ND | ND | ND | ND | ND |
| Methapyrene | ND | ND | ND | ND | ND | ND | ND |
| Fluoranthene | ND | ND | ND | ND | ND | ND | ND |
| Benzidine | ND | ND | ND | ND | ND | ND | ND |
| Pyrene | ND | ND | ND | ND | ND | ND | ND |
| p-Dimethylaminoazobenzene | ND | ND | ND | ND | ND | ND | ND |
| Chlorobenzilate | ND | ND | ND | ND | ND | ND | ND |
| Kepone | ND | ND | ND | ND | ND | ND | ND |
| Butylbenzylphthalate | ND | ND | ND | ND | ND | ND | ND |
| 3,3'-Dimethylbenzidine | ND | ND | ND | ND | ND | ND | ND |
| 2-Acetylaminofluorene | ND | ND | ND | ND | ND | ND | ND |
| bis(2-Ethylhexyl)phthalate | ND | 1.124E-02 | ND | ND | ND | ND | ND |

Table B-3: Air Modeling Output Data for Semi-Volatile Organic Compounds

| Compound | Measured Actual Concentration (mg/m ³) | Measured Background Concentration (mg/m ³) | Average Adjusted Emission Factor (lb/lb NEW) | Average Adjusted Emission Factor (lb/item) | Total Mass of Pollutant Emitted Per Item (grams) | Average Modeled Concentration for One Item (grams/m ³) | Pollutant Emission Rate for One Item (grams/sec) |
|---|--|--|--|--|--|--|--|
| 3,3'-Dichlorobenzidine | ND | ND | ND | ND | ND | ND | ND |
| Benz(a)anthracene | ND | ND | ND | ND | ND | ND | ND |
| Chrysene | ND | ND | ND | ND | ND | ND | ND |
| Di-n-octylphthalate | ND | ND | ND | ND | ND | ND | ND |
| 7,12-Dimethylbenz(a)anthracene | ND | ND | ND | ND | ND | ND | ND |
| Benzo(b)fluoranthene | ND | ND | ND | ND | ND | ND | ND |
| Benzo(k)fluoranthene | ND | ND | ND | ND | ND | ND | ND |
| Benz(a)pyrene | ND | ND | ND | ND | ND | ND | ND |
| 3-Methylcholanthrene | ND | ND | ND | ND | ND | ND | ND |
| Indeno(1,2,3-cd)pyrene | ND | ND | ND | ND | ND | ND | ND |
| Dibenz(a,h)anthracene | ND | ND | ND | ND | ND | ND | ND |
| Benzo(g,h,i)perylene | ND | ND | ND | ND | ND | ND | ND |
| Particulate/Vapor-phase SVOCs (Tentatively Identified Compounds) | | | | | | | |
| 2-(2-quinoliny)-(H-indene-1,3-(2H)-dione (a) | ND | ND | ND | ND | ND | ND | ND |
| Benzanthrone (b) | ND | ND | ND | ND | ND | ND | ND |
| Tetrachloroethene | ND | ND | ND | ND | ND | ND | ND |
| (1,2-dichloroethyl)-benzene | ND | ND | ND | ND | ND | ND | ND |
| 4-phenoxy-2(1H)-quinolinone (a) | 5.172E+02 | ND | 3.152E-02 | 2.269E-02 | 1.029E+01 | 3.011E-04 | 8.578E-02 |
| 3-(phenylhydrazono)-1H-indole-2,3-dione | 5.172E+02 | ND | 3.152E-02 | 2.269E-02 | 1.029E+01 | 3.011E-04 | 8.578E-02 |
| 4-1,2,4-oxadiazolin-3-one-2,5-diphenyl-delta | 2.586E+01 | ND | 1.576E-03 | 1.135E-03 | 5.147E-01 | 1.506E-05 | 4.289E-03 |
| 2-amino-9,10-anthracenedione (a) | ND | ND | ND | ND | ND | ND | ND |
| Footnotes: | | | | | | | |
| ND = Not Detected | | | | | | | |
| NEW = Net Explosive Weight | | | | | | | |

APPENDIX C

HEALTH-BASED SCREENING LEVELS AND ACUTE TOXICITY VALUES

Appendix C: Health-Based Screening Levels and Acute Toxicity Values

| Compound | CAS # | For the Chronic Evaluation (HBSL) | | | | | For the Acute Evaluation (ATV) | | | | |
|-----------------------------------|------------|---|-----------------------------------|---|-----------------------------------|---|--------------------------------|------------------------------|------------------------------|----------------------|---|
| | | Region 9 PRG (µg/m ³) | Toxicity Endpoint (c or nc) | Region 3 RBC (µg/m ³) | Toxicity Endpoint (c or nc) | Health-based Screening Level (µg/m ³) | ERPG (µg/m ³) | TEEL (µg/m ³) | AEGL (µg/m ³) | Source (A-E or T) | Acute Toxicity Value (µg/m ³) |
| TSP | 12789-66-1 | 5.00E+01 | | NA | | 5.00E+01 | NA | NA | NA | | |
| HCl | 7647-01-0 | 2.08E+01 | nc | 2.08E+01 | nc | 2.08E+01 | NA | 4.47E+03 | NA | T | 4.47E+03 |
| Cl ₂ | 7782-50-5 | 2.09E-01 | nc | 3.65E+02 | nc | 2.09E-01 | 2.89E+03 | 2.90E+03 | 2.90E+03 | A | 2.90E+03 |
| Dioxin TEQ | 1746-01-6 | 4.48E-08 | c | 4.17E-08 | c | 4.48E-08 | NA | 3.50E+00 | NA | T | 3.50E+00 |
| Carbon Monoxide (CO) | 630-08-0 | 1.57E+02 | | NA | | 1.57E+02 | 2.30E+05 | 2.28E+05 | NA | E | 2.30E+05 |
| Nitrogen Oxide (NOx) | 10024-97-2 | 1.00E+02 | | NA | | 1.00E+02 | NA | 2.70E+05 | NA | T | 2.70E+05 |
| HCl (CEM System) | 7647-01-0 | 2.08E+01 | nc | 2.08E+01 | nc | 2.08E+01 | NA | 4.47E+03 | NA | T | 4.47E+03 |
| Carbon Dioxide (CO ₂) | 124-38-9 | NA | | NA | | NA | NA | 5.40E+07 | NA | T | 5.40E+07 |
| Sulfur Dioxide (SO ₂) | 7446-09-5 | 8.00E+01 | | NA | | 8.00E+01 | 7.89E+02 | 7.86E+02 | NA | E | 7.89E+02 |
| Aluminum | 7429-90-5 | NA | | 3.65E+00 | nc | 3.65E+00 | NA | 3.00E+04 | NA | T | 3.00E+04 |
| Antimony | 7440-36-0 | NA | | 1.46E+00 | nc | 1.46E+00 | NA | 1.50E+03 | NA | T | 1.50E+03 |
| Arsenic | 7440-38-2 | 4.47E-04 | c | 4.15E-04 | c | 4.47E-04 | NA | 3.00E+01 | NA | T | 3.00E+01 |
| Barium | 7440-39-3 | 5.21E-01 | nc | 5.11E-01 | nc | 5.21E-01 | NA | 1.50E+03 | NA | T | 1.50E+03 |
| Beryllium | 7440-41-7 | 8.00E-04 | c | 7.45E-04 | c | 8.00E-04 | NA | 5.00E+00 | NA | T | 5.00E+00 |
| Cadmium | 7440-43-9 | 1.07E-03 | c | 9.94E-04 | c | 1.07E-03 | NA | 3.00E+01 | NA | T | 3.00E+01 |
| Chromium | 7440-47-3 | NA | c | 1.53E-04 | c | 1.53E-04 | NA | 1.50E+03 | NA | T | 1.50E+03 |
| Cobalt | 7440-48-4 | NA | | 2.20E+02 | nc | 2.20E+02 | NA | 6.00E+01 | NA | T | 6.00E+01 |
| Copper | 7440-50-8 | NA | | 1.46E+02 | nc | 1.46E+02 | NA | 3.00E+03 | NA | T | 3.00E+03 |
| Lead | 7439-92-1 | 1.50E+00 | | NA | | 1.50E+00 | NA | 1.50E+02 | NA | T | 1.50E+02 |
| Magnesium | 7439-95-4 | NA | | NA | | NA | NA | 3.00E+04 | NA | T | 3.00E+04 |
| Manganese | 7439-96-5 | 5.11E-02 | nc | 5.22E-02 | nc | 5.11E-02 | NA | 3.00E+03 | NA | T | 3.00E+03 |
| Nickel | 7440-02-0 | NA | | 7.30E+01 | nc | 7.30E+01 | NA | 3.00E+03 | NA | T | 3.00E+03 |
| Phosphorus | 7723-14-0 | NA | | NA | | NA | NA | 3.00E+02 | NA | T | 3.00E+02 |
| Selenium | 7782-49-2 | NA | | 1.83E+01 | nc | 1.83E+01 | NA | 6.00E+02 | NA | T | 6.00E+02 |
| Silver | 7740-22-4 | NA | | 1.83E+01 | nc | 1.83E+01 | NA | 3.00E+02 | NA | T | 3.00E+02 |
| Thallium | 7440-28-0 | NA | | 2.56E-01 | nc | 2.56E-01 | NA | 3.00E+02 | NA | T | 3.00E+02 |
| Zinc | 7440-66-6 | NA | | 1.10E+03 | nc | 1.10E+03 | NA | 3.00E+04 | NA | T | 3.00E+04 |
| Mercury | 7439-97-6 | 3.13E-01 | nc | 3.14E-01 | nc | 3.13E-01 | NA | 1.00E+02 | NA | T | 1.00E+02 |
| TNMC | | NA | | NA | | NA | NA | NA | NA | | |
| Ethane | 74-84-0 | NA | | NA | | NA | NA | NA | NA | | |
| Ethylene | 74-85-1 | NA | | NA | | NA | NA | 4.60E+05 | NA | T | 4.60E+05 |
| Acetylene | 74-86-2 | NA | | NA | | NA | NA | NA | NA | | |
| Propane | 74-98-6 | NA | | NA | | NA | NA | 3.78E+06 | NA | T | 3.78E+06 |
| Propene | 115-07-1 | NA | | NA | | NA | NA | NA | NA | | |
| i-Butane | 106-97-8 | NA | | NA | | NA | NA | 5.71E+06 | NA | T | 5.71E+06 |

Appendix C: Health-Based Screening Levels and Acute Toxicity Values

| Chemical Compound | CAS # | For the Chronic Evaluation (HBSL) | | | | | For the Acute Evaluation (ATV) | | | | |
|------------------------|------------|-----------------------------------|--------------------------|----------------------|--------------------------|--------------------------------------|--------------------------------|--------------|--------------|--------------|------------------------------|
| | | Region 9 PRG (µg/m³) | Toxicity Endpoint (Conc) | Region 3 RBC (µg/m³) | Toxicity Endpoint (Conc) | Health-based Screening Level (µg/m³) | ERPG (µg/m³) | TEEL (µg/m³) | AEGL (µg/m³) | Source (ATV) | Acute Toxicity Value (µg/m³) |
| i-Butene | 25167-67-3 | NA | | NA | | NA | NA | NA | NA | | |
| 1-Butene | 106-98-9 | NA | | NA | | NA | NA | NA | NA | | |
| 1,3-Butadiene | 106-99-0 | 3.74E-03 | c | 3.48E-03 | c | 3.74E-03 | 2.20E+04 | 2.21E+04 | NA | E | 2.20E+04 |
| n-Butane | 106-97-8 | NA | | NA | | NA | NA | 5.71E+06 | NA | T | 5.71E+06 |
| trans-2-Butene | 624-64-6 | NA | | NA | | NA | NA | NA | NA | | |
| 2,2-Dimethylpropane | 463-82-1 | NA | | NA | | NA | NA | NA | NA | | |
| cis-2-Butene | 590-18-1 | NA | | NA | | NA | NA | NA | NA | | |
| 3-Methyl-1-butene | 563-45-1 | NA | | NA | | NA | NA | NA | NA | | |
| i-Pentane | 109-66-0 | NA | | NA | | NA | NA | 1.80E+06 | NA | T | 1.80E+06 |
| 1-Pentene | 109-67-1 | NA | | NA | | NA | NA | NA | NA | | |
| 2-Methyl-1-butene | 563-46-2 | NA | | NA | | NA | NA | NA | NA | | |
| n-Pentane | 109-66-0 | NA | | NA | | NA | NA | 1.80E+06 | NA | T | 1.80E+06 |
| Isoprene | 78-79-5 | NA | | NA | | NA | NA | NA | NA | | |
| trans-2-Pentene | 646-04-8 | NA | | NA | | NA | NA | NA | NA | | |
| cis-2-Pentene | 627-20-3 | NA | | NA | | NA | NA | NA | NA | | |
| 2-Methyl-2-butene | 513-35-9 | NA | | NA | | NA | NA | NA | NA | | |
| 2,2-Dimethylbutane | 75-83-2 | NA | | NA | | NA | NA | 1.80E+06 | NA | T | 1.80E+06 |
| Cyclopentene | 142-29-0 | NA | | NA | | NA | NA | NA | NA | | |
| 4-Methyl-1-pentene | 691-37-2 | NA | | NA | | NA | NA | NA | NA | | |
| Cyclopentane | 287-92-3 | NA | | NA | | NA | NA | NA | NA | | |
| 2,3-Dimethylbutane | 79-29-8 | NA | | NA | | NA | NA | NA | NA | | |
| cis-4-Methyl-2-pentene | 691-38-3 | NA | | NA | | NA | NA | NA | NA | | |
| 2-Methylpentane | 107-83-5 | NA | | NA | | NA | NA | 1.80E+06 | NA | T | 1.80E+06 |
| 3-Methylpentane | 96-14-0 | NA | | NA | | NA | NA | NA | NA | | |
| 2-Methyl-1-pentene | 763-29-1 | NA | | NA | | NA | NA | NA | NA | | |
| 1-Hexene | 592-41-6 | NA | | NA | | NA | NA | 1.03E+05 | NA | T | 1.03E+05 |
| n-Hexane | 110-54-3 | 2.10E+02 | nc | 2.08E+02 | nc | 2.10E+02 | NA | 5.28E+05 | NA | T | 5.28E+05 |
| trans-2-Hexene | 4050-45-7 | NA | | NA | | NA | NA | NA | NA | | |
| 2-Methyl-2-pentene | 625-27-4 | NA | | NA | | NA | NA | NA | NA | | |
| cis-2-Hexene | 7688-21-3 | NA | | NA | | NA | NA | NA | NA | | |
| Methylcyclopentane | 96-37-7 | NA | | NA | | NA | NA | NA | NA | | |
| 2,4-Dimethylpentane | 108-08-7 | NA | | NA | | NA | NA | NA | NA | | |
| Benzene | 71-43-2 | 2.50E-01 | c | 2.16E-01 | c | 2.50E-01 | 1.56E+05 | 1.60E+05 | NA | E | 1.56E+05 |
| Cyclohexane | 110-82-7 | NA | | NA | | NA | NA | 3.10E+06 | NA | T | 3.10E+06 |
| 2-Methylhexane | 591-76-4 | NA | | NA | | NA | NA | NA | NA | | |
| 2,3-Dimethylpentane | 565-59-3 | NA | | NA | | NA | NA | NA | NA | | |

Appendix C: Health-Based Screening Levels and Acute Toxicity Values

| Compound | CAS # | For the Chronic Evaluation (HBSL) | | | | | For the Acute Evaluation (ATV) | | | | |
|---|------------|---|-----------------------------------|---|-----------------------------------|---|--------------------------------------|--------------------------------------|--------------------------------------|-----------------------|---|
| | | Region 9 PRG ($\mu\text{g}/\text{m}^3$) | Toxicity Endpoint (c or nc) | Region 9 RBC ($\mu\text{g}/\text{m}^3$) | Toxicity Endpoint (c or nc) | Health-based Screening Level ($\mu\text{g}/\text{m}^3$) | ERPG ($\mu\text{g}/\text{m}^3$) | TEEL ($\mu\text{g}/\text{m}^3$) | AEGL ($\mu\text{g}/\text{m}^3$) | Source (A, E or T) | Acute Toxicity Value ($\mu\text{g}/\text{m}^3$) |
| 3-Methylhexane | 589-34-4 | NA | | NA | | NA | NA | NA | NA | | |
| 2,2,4-Trimethylpentane | 540-84-1 | NA | | NA | | NA | NA | 3.50E+05 | NA | T | 3.50E+05 |
| n-Heptane | 142-82-5 | NA | | NA | | NA | NA | 1.80E+06 | NA | T | 1.80E+06 |
| 2,4,4-Trimethyl-1-pentene | 107-39-1 | NA | | NA | | NA | NA | NA | NA | | |
| Methylcyclohexane | 108-87-2 | 3.10E+03 | nc | 3.14E+03 | nc | 3.10E+03 | NA | 4.81E+06 | NA | T | 4.81E+06 |
| 2,4,4-Trimethyl-2-pentene | 107-40-4 | NA | | NA | | NA | NA | NA | NA | | |
| 2,5-Dimethylhexane | 592-13-2 | NA | | NA | | NA | NA | NA | NA | | |
| 2,4-Dimethylhexane | 589-43-5 | NA | | NA | | NA | NA | NA | NA | | |
| 2,3,4-Trimethylpentane | 565-59-3 | NA | | NA | | NA | NA | NA | NA | | |
| Toluene | 108-88-3 | 4.02E+02 | nc | 4.16E+02 | nc | 4.02E+02 | 1.88E+05 | 1.89E+05 | NA | E | 1.88E+05 |
| 2,3-Dimethylhexane | 584-94-1 | NA | | NA | | NA | NA | NA | NA | | |
| 2-Methylheptane | 592-27-8 | NA | | NA | | NA | NA | NA | NA | | |
| 3-Ethylhexane | 619-99-8 | NA | | NA | | NA | NA | NA | NA | | |
| 2,2-Dimethylheptane | 1071-26-7 | NA | | NA | | NA | NA | NA | NA | | |
| 2,2,4-Trimethylhexane | 16747-26-5 | NA | | NA | | NA | NA | NA | NA | | |
| n-Octane | 111-65-9 | NA | | NA | | NA | NA | NA | NA | | |
| Ethylcyclohexane | 1678-91-7 | NA | | NA | | NA | NA | NA | NA | | |
| Ethylbenzene | 100-41-4 | 1.10E+03 | nc | 1.06E+03 | nc | 1.10E+03 | NA | 5.43E+05 | NA | T | 5.43E+05 |
| m-Xylene & p-Xylene | 108-38-3 | NA | | NA | | NA | NA | 6.51E+05 | NA | T | 6.51E+05 |
| Styrene | 100-42-5 | 1.10E+03 | nc | 1.04E+03 | nc | 1.10E+03 | 2.13E+05 | 2.13E+05 | NA | E | 2.13E+05 |
| o-Xylene | 95-47-6 | 7.30E+02 | nc | 7.30E+03 | nc | 7.30E+02 | NA | 6.51E+05 | NA | T | 6.51E+05 |
| n-Nonane | 111-84-2 | NA | | 4.02E+02 | nc | 4.02E+02 | NA | 1.05E+06 | NA | T | 1.05E+06 |
| i-Propylbenzene | 98-82-8 | 4.00E+02 | nc | 4.02E+02 | nc | 4.00E+02 | NA | 7.37E+05 | NA | T | 7.37E+05 |
| n-Propylbenzene | 103-65-1 | 3.65E+01 | nc | 1.46E+02 | nc | 3.65E+01 | NA | 3.68E+05 | NA | T | 3.68E+05 |
| p-Ethyltoluene | 622-96-8 | NA | | NA | | NA | NA | 1.25E+05 | NA | T | 1.25E+05 |
| m-Ethyltoluene | 620-14-4 | NA | | NA | | NA | NA | NA | NA | | |
| 1,3,5-Trimethylbenzene | 108-67-8 | 6.20E+00 | nc | 6.21E+00 | nc | 6.20E+00 | NA | 3.68E+05 | NA | T | 3.68E+05 |
| o-Ethyltoluene | 611-14-3 | NA | | NA | | NA | NA | 7.50E+02 | NA | T | 7.50E+02 |
| 1,2,4-Trimethylbenzene & sec-Butylbenzene | 95-63-6 | 6.21E+00 | nc | 6.21E+00 | nc | 6.21E+00 | NA | 1.80E+05 | NA | T | 1.80E+05 |
| n-Decane | 124-18-5 | NA | | NA | | NA | NA | 4.37E+03 | NA | T | 4.37E+03 |
| alpha-Pinene | 80-56-8 | NA | | NA | | NA | NA | 4.00E+04 | NA | T | 4.00E+04 |
| beta-Pinene | 127-91-3 | NA | | NA | | NA | NA | NA | NA | | |
| delta-3-Carene | 13466-78-9 | NA | | NA | | NA | NA | NA | NA | | |
| d-Limonene | 5989-27-5 | NA | | NA | | NA | NA | NA | NA | | |
| MTBE | 1634-04-4 | 3.10E+03 | nc | 3.13E+03 | nc | 3.10E+03 | NA | 3.50E+05 | NA | T | 3.50E+05 |
| Dichlorodifluoromethane | 75-71-8 | 2.10E+02 | nc | 1.83E+02 | nc | 2.10E+02 | NA | 4.32E+05 | NA | T | 4.32E+05 |
| | | | | | | | NA | 1.48E+07 | NA | T | 1.48E+07 |

Appendix C: Health-Based Screening Levels and Acute Toxicity Values

| Compound | CAS# | For the Chronic Evaluation (HBSL) | | | | | For the Acute Evaluation (ATV) | | | | |
|---------------------------------------|------------|-----------------------------------|----------------------------------|--------------------------|----------------------------------|--|--------------------------------|-----------------|-----------------|---------------------|------------------------------------|
| | | Region PRG (ug/ml) | Toxicity Endpoint (G-or-n) | Region RBC (ug/ml) | Toxicity Endpoint (G-or-n) | Health-based Screening Level (ug/ml) | ERPG (ug/ml) | TEEL (ug/ml) | AEGL (ug/ml) | Source (A/E/O/T) | Acute Toxicity Value (ug/ml) |
| Methylchloride | 74-87-33 | 1.07E+00 | c | 1.79E+00 | c | 1.07E+00 | NA | NA | NA | | |
| Dichlorotetrafluoroethane | 374-07-2 | NA | | NA | | NA | NA | NA | NA | | |
| Chloroethene | 75-01-4 | 2.20E-02 | c | 2.09E-02 | c | 2.20E-02 | NA | 1.28E+04 | NA | T | 1.28E+04 |
| 1,3-Butadiene | 106-99-0 | 3.74E-03 | c | 3.48E-03 | c | 3.74E-03 | 2.20E+04 | 2.21E+04 | NA | E | 2.20E+04 |
| Methylbromide | 74-83-9 | 5.20E+00 | nc | 5.11E+00 | nc | 5.20E+00 | NA | 5.82E+04 | NA | T | 5.82E+04 |
| Ethylchloride | 75-00-3 | 2.30E+00 | c | 2.16E+00 | c | 2.30E+00 | NA | 7.92E+06 | NA | T | 7.92E+06 |
| Trichloromonofluoromethane | 75-69-4 | 7.30E+02 | nc | 7.30E+02 | nc | 7.30E+02 | NA | 2.81E+06 | NA | T | 2.81E+06 |
| Vinylidene chloride | 75-35-4 | 3.84E-02 | c | 3.58E-02 | c | 3.84E-02 | NA | 7.92E+04 | NA | T | 7.92E+04 |
| Methylene chloride | 75-09-2 | 4.10E+00 | c | 3.79E+00 | c | 4.10E+00 | 6.96E+05 | 6.94E+05 | NA | E | 6.96E+05 |
| Allyl chloride | 107-05-1 | 1.04E+00 | nc | NA | | 1.04E+00 | 9.39E+03 | 9.39E+03 | NA | E | 9.39E+03 |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | 76-13-1 | 3.13E+04 | nc | 3.14E+04 | nc | 3.13E+04 | NA | 9.58E+06 | NA | T | 9.58E+06 |
| 1,1-Dichloroethane | 75-34-3 | 5.21E+02 | nc | 5.11E+02 | nc | 5.21E+02 | NA | 1.21E+06 | NA | T | 1.21E+06 |
| 1,2-Dichloroethene | 540-59-0 | NA | | 3.29E+01 | nc | 3.29E+01 | NA | 2.38E+06 | 5.30E+04 | A | 5.30E+04 |
| Chloroform | 67-66-3 | 8.35E-02 | c | 7.73E-02 | c | 8.35E-02 | NA | 9.76E+03 | NA | T | 9.76E+03 |
| 1,2-Dichloroethane | 107-06-2 | 7.39E-02 | c | 6.88E-02 | c | 7.39E-02 | NA | 8.08E+03 | NA | T | 8.08E+03 |
| Methylchloroform | 71-55-6 | 1.04E+03 | nc | 2.30E+03 | nc | 1.04E+03 | 1.94E+06 | 1.91E+06 | NA | E | 1.94E+06 |
| Benzene | 71-43-2 | 2.49E-01 | c | 2.16E-01 | c | 2.49E-01 | NA | 1.60E+05 | NA | T | 1.60E+05 |
| Carbon tetrachloride | 56-23-5 | 1.28E-01 | nc | 1.18E-01 | nc | 1.28E-01 | 1.28E+05 | 1.26E+05 | NA | E | 1.28E+05 |
| 1,2-Dichloropropane | 78-87-5 | 9.89E-02 | c | 9.21E-02 | c | 9.89E-02 | NA | 5.08E+05 | NA | T | 5.08E+05 |
| Trichloroethylene | 79-01-6 | 1.12E+00 | c | 1.04E+00 | c | 1.12E+00 | NA | 5.37E+05 | NA | T | 5.37E+05 |
| cis 1,3-Dichloro-1-propene | 10061-01-5 | NA | | NA | | NA | NA | 1.14E+04 | NA | T | 1.14E+04 |
| trans 1,3-Dichloro-1-propene | 10061-02-6 | NA | | NA | | NA | NA | NA | NA | | |
| 1,1,2-Trichloroethane | 79-00-5 | 1.20E-01 | c | 1.12E-01 | c | 1.20E-01 | NA | 1.64E+05 | NA | T | 1.64E+05 |
| Toluene | 108-88-3 | 4.02E+02 | nc | 4.16E+02 | nc | 4.02E+02 | 1.88E+05 | 1.89E+05 | NA | E | 1.88E+05 |
| 1,2-Dibromoethane | 106-93-4 | 8.73E-03 | c | 8.24E-03 | c | 8.73E-03 | NA | 1.54E+05 | NA | T | 1.54E+05 |
| Perchloroethylene | 127-18-4 | 3.31E+00 | c | 3.13E+00 | c | 3.31E+00 | 6.89E+05 | 6.78E+05 | NA | E | 6.89E+05 |
| Chlorobenzene | 108-90-7 | 6.20E+01 | nc | 6.21E+01 | nc | 6.20E+01 | NA | 1.38E+05 | NA | T | 1.38E+05 |
| Ethylbenzene | 100-41-4 | 1.06E+03 | nc | 1.06E+03 | nc | 1.06E+03 | NA | 5.43E+05 | NA | T | 5.43E+05 |
| m,p-Xylene | 108-38-3 | 7.30E+02 | nc | NA | | 7.30E+02 | NA | 6.51E+05 | NA | T | 6.51E+05 |
| Styrene | 100-42-5 | 1.06E+03 | nc | 1.04E+03 | nc | 1.06E+03 | 2.13E+05 | 2.13E+05 | NA | E | 2.13E+05 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 | 3.31E-02 | c | 3.13E-02 | c | 3.31E-02 | NA | 2.06E+04 | NA | T | 2.06E+04 |
| o-Xylene | 95-47-6 | 7.30E+02 | nc | 7.30E+03 | nc | 7.30E+02 | NA | 6.51E+05 | NA | T | 6.51E+05 |
| p-Ethyltoluene | 622-96-8 | NA | | NA | | NA | NA | 1.25E+05 | NA | T | 1.25E+05 |
| 1,3,5-Trimethylbenzene | 108-67-8 | 6.21E+00 | nc | 6.21E+00 | nc | 6.21E+00 | NA | 3.68E+05 | NA | T | 3.68E+05 |
| 1,2,4-Trimethylbenzene | 95-63-6 | 6.21E+00 | nc | 6.21E+00 | nc | 6.21E+00 | NA | 1.80E+05 | NA | T | 1.80E+05 |
| Benzylchloride | 100-44-7 | 3.96E-02 | nc | 3.68E-02 | c | 3.96E-02 | 5.20E+03 | 5.17E+03 | NA | E | 5.20E+03 |

Appendix C: Health-Based Screening Levels and Acute Toxicity Values

| Compound | CAS # | For the Chronic Evaluation (HBSL) | | | | | For the Acute Evaluation (ATV) | | | | |
|------------------------------|------------|---|-----------------------------------|---|-----------------------------------|---|--------------------------------|------------------------------|------------------------------|-----------------------|---|
| | | Region 9 PRG (µg/m ³) | Toxicity Endpoint (c or nc) | Region 3 RBC (µg/m ³) | Toxicity Endpoint (c or nc) | Health-based Screening Level (µg/m ³) | ERPG (µg/m ³) | TEEL (µg/m ³) | AEGL (µg/m ³) | Source (A, E or T) | Acute Toxicity Value (µg/m ³) |
| m-Dichlorobenzene | 541-73-1 | 3.29E+00 | nc | 3.29E+00 | nc | 3.29E+00 | NA | 3.61E+04 | NA | T | 3.61E+04 |
| p-Dichlorobenzene | 106-46-7 | 3.06E-01 | c | 2.85E-01 | c | 3.06E-01 | NA | 6.61E+05 | NA | T | 6.61E+05 |
| o-Dichlorobenzene | 95-50-1 | 2.09E+02 | nc | 3.29E+01 | nc | 2.09E+02 | NA | 3.01E+05 | NA | T | 3.01E+05 |
| 1,2,4-Trichlorobenzene | 120-82-1 | 2.08E+02 | nc | 2.08E+02 | nc | 2.08E+02 | NA | 3.71E+04 | NA | T | 3.71E+04 |
| Hexachlorobutadiene | 87-68-3 | 8.73E-02 | c | 8.03E-02 | c | 8.73E-02 | 3.21E+04 | 3.20E+04 | NA | E | 3.21E+04 |
| Phenylacetylene | 536-74-3 | NA | | NA | | NA | NA | NA | NA | | |
| d-Limonene | 5989-27-5 | NA | | NA | | NA | NA | 3.50E+05 | NA | T | 3.50E+05 |
| Methylnitrite | 624-91-9 | NA | | NA | | NA | NA | NA | NA | | |
| Acetonitrile | 75-05-8 | 6.20E+01 | nc | 6.21E+01 | nc | 6.20E+01 | NA | 1.01E+05 | NA | T | 1.01E+05 |
| Acrylonitrile | 107-13-1 | 2.80E-02 | c | 2.61E-02 | c | 2.80E-02 | 2.20E+04 | 2.17E+04 | NA | E | 2.20E+04 |
| Nitromethane | 75-52-5 | NA | | NA | | NA | NA | 1.50E+05 | NA | T | 1.50E+05 |
| Benzonitrile | 100-47-0 | NA | | NA | | NA | NA | 1.50E+04 | NA | T | 1.50E+04 |
| Nitrobenzene | 98-95-3 | 2.09E+00 | nc | 2.19E+00 | nc | 2.09E+00 | NA | 1.51E+04 | NA | T | 1.51E+04 |
| 4-Methylbenzonitrile | 104-85-8 | NA | | NA | | NA | NA | NA | NA | | |
| Carbon Disulfide | 75-15-0 | 7.30E+02 | nc | 7.30E+02 | nc | 7.30E+02 | NA | 3.73E+04 | NA | T | 3.73E+04 |
| Thiophene | 110-02-1 | NA | | NA | | NA | NA | NA | NA | | |
| Dimethyldisulfide | 624-92-0 | NA | | NA | | NA | 4.00E+01 | 3.85E+01 | NA | E | 4.00E+01 |
| 2-Methylthiophene | 554-14-3 | NA | | NA | | NA | NA | NA | NA | | |
| 3-Methylthiophene | 616-44-4 | NA | | NA | | NA | NA | NA | NA | | |
| Dimethyltrisulfide | 3658-80-8 | NA | | NA | | NA | NA | NA | NA | | |
| 1-Chlorobutane | 109-69-3 | 1.46E+03 | nc | 1.46E+03 | nc | 1.46E+03 | NA | NA | NA | | |
| 1-Bromo-2-chloroethane | 107-04-0 | NA | | NA | | NA | NA | NA | NA | | |
| 2-Bromo-1-chloropropane | 3017-95-6 | NA | | NA | | NA | NA | NA | NA | | |
| 1,2-Dichlorobutane | 541-33-3 | NA | | NA | | NA | NA | NA | NA | | |
| 1,2,3-Trichloropropane | 96-18-4 | 9.61E-04 | c | 3.13E-03 | c | 9.61E-04 | NA | 1.81E+05 | NA | T | 1.81E+05 |
| 1-Chloro-2-methylbenzene | 95-49-8 | 7.30E+01 | nc | 7.30E+01 | nc | 7.30E+01 | NA | 3.88E+05 | NA | T | 3.88E+05 |
| 1-Chloro-3-methylbenzene | 108-41-8 | NA | | NA | | NA | NA | NA | NA | | |
| 1-Chloro-4-ethylbenzene | 622-98-0 | NA | | NA | | NA | NA | NA | NA | | |
| Pentachloro-1-propene | 1600-37-9 | NA | | NA | | NA | NA | NA | NA | | |
| Hexachloroethane | 67-72-1 | 4.80E-01 | c | 4.47E-01 | c | 4.80E-01 | NA | 2.90E+04 | NA | T | 2.90E+04 |
| 1,2-Dichloro-3-methylbenzene | 32768-54-0 | NA | | NA | | NA | NA | 9.84E+03 | NA | T | 9.84E+03 |
| Carbonyl Sulfide | 463-58-1 | NA | | NA | | NA | NA | NA | NA | | |
| Trichloroacetonitrile | 545-06-2 | NA | | NA | | NA | NA | NA | NA | | |
| Dichloroacetonitrile | 3018-12-0 | NA | | NA | | NA | NA | NA | NA | | |
| Isothiocyanatomethane | 556-61-6 | NA | | NA | | NA | NA | NA | NA | | |
| 1,1-Dichloro-2-propanone | 513-88-2 | NA | | NA | | NA | NA | NA | NA | | |

Appendix C: Health-Based Screening Levels and Acute Toxicity Values

| Compound | CAS | For the Chronic Evaluation (HBSL) | | | | | For the Acute Evaluation (ATV) | | | | |
|------------------------------|-----------|-----------------------------------|--------------------------|----------------------|--------------------------|--------------------------------------|--------------------------------|--------------|--------------|----------------|------------------------------|
| | | Region 9 PRG (µg/m³) | Toxicity Endpoint (C-09) | Region 9 RBC (µg/m³) | Toxicity Endpoint (C-09) | Health-Based Screening Level (µg/m³) | ERRG (µg/m³) | TEEL (µg/m³) | AEGI (µg/m³) | Source (AE-03) | Acute Toxicity Value (µg/m³) |
| 2-Thiophenecarboxaldehyde | 98-03-3 | NA | | NA | | NA | NA | NA | NA | | |
| Acetaldehyde | 75-07-0 | 8.73E-01 | c | 8.13E-01 | c | 8.73E-01 | 1.80E+04 | 1.80E+04 | NA | E | 1.80E+04 |
| Ethanol | 64-17-5 | NA | | NA | | NA | | 5.64E+06 | NA | T | 5.64E+06 |
| Acrolein | 107-02-8 | 2.09E-02 | nc | 2.08E-02 | nc | 2.09E-02 | 2.30E+02 | 2.29E+02 | NA | E | 2.30E+02 |
| Acetone | 67-64-1 | 3.40E+02 | nc | 3.65E+02 | nc | 3.40E+02 | NA | 2.37E+06 | NA | T | 2.37E+06 |
| Propanal | 123-38-6 | NA | | NA | | NA | NA | 7.50E+04 | NA | T | 7.50E+04 |
| Furan | 110-00-9 | 3.70E+00 | nc | NA | | 3.70E+00 | NA | 1.67E+02 | NA | T | 1.67E+02 |
| 2-Propanol | 67-63-0 | NA | | NA | | NA | NA | 9.84E+05 | NA | T | 9.84E+05 |
| Methacrolein | 78-85-3 | NA | | NA | | NA | NA | NA | NA | | |
| MTBE | 1634-04-4 | 3.10E+03 | nc | 3.13E+03 | nc | 3.10E+03 | NA | 4.32E+05 | NA | T | 4.32E+05 |
| Methyl-vinyl ketone | 78-94-4 | NA | | NA | | NA | NA | 8.61E+01 | NA | T | 8.61E+01 |
| 2-Butanediol | 625-34-3 | NA | | NA | | NA | NA | NA | NA | | |
| Butanal | 123-72-8 | NA | | NA | | NA | NA | 7.38E+04 | NA | T | 7.38E+04 |
| 2-Butanone | 78-93-3 | 1.00E+03 | nc | 1.04E+03 | nc | 1.00E+03 | NA | 8.85E+05 | NA | T | 8.85E+05 |
| 2-Methylfuran | 534-22-5 | NA | | NA | | NA | NA | NA | NA | | |
| 3-Methylfuran | 930-27-8 | NA | | NA | | NA | NA | NA | NA | | |
| trans-2-Butenal | 123-73-9 | 3.54E-03 | c | 3.30E-03 | c | 3.54E-03 | NA | NA | NA | | |
| Tetrahydrofuran | 109-99-9 | 9.89E-01 | c | 9.21E-01 | c | 9.89E-01 | NA | 7.38E+05 | NA | T | 7.38E+05 |
| 3-Methyl-2-butanone | 108-10-1 | 8.30E+01 | nc | 7.30E+01 | nc | 8.30E+01 | NA | 3.07E+05 | NA | T | 3.07E+05 |
| Acetic Acid | 64-19-7 | NA | | NA | | NA | NA | 3.68E+04 | NA | T | 3.68E+04 |
| 1-Butanol | 71-36-3 | 3.65E+02 | nc | 3.65E+02 | nc | 3.65E+02 | NA | 1.52E+05 | NA | T | 1.52E+05 |
| 1-Penten-3-one | 1629-58-9 | NA | | NA | | NA | NA | 8.80E+05 | NA | T | 8.80E+05 |
| 2-Pentanone | 107-87-9 | NA | | NA | | NA | NA | NA | NA | | |
| Pentanal | 110-62-3 | NA | | NA | | NA | NA | NA | NA | | |
| 2,3-Pentanedione | 600-14-6 | NA | | NA | | NA | NA | NA | NA | | |
| 1,2-Dichloro-2-methylpropane | 594-37-6 | NA | | NA | | NA | NA | NA | NA | | |
| 3-Pentanone | 96-22-0 | NA | | NA | | NA | NA | NA | NA | | |
| 2,5-Dimethylfuran | 625-86-5 | NA | | NA | | NA | NA | NA | NA | | |
| 4-Methyl-2-pentanone | 108-10-1 | 8.30E+01 | nc | 7.30E+01 | nc | 8.30E+01 | NA | 3.07E+05 | NA | T | 3.07E+05 |
| trans-3-Penten-2-one | 3102-33-8 | NA | | NA | | NA | NA | NA | NA | | |
| Cyclopentanone | 120-92-3 | NA | | NA | | NA | NA | NA | NA | | |
| 2-Hexanone | 591-78-6 | NA | | NA | | NA | NA | 4.09E+04 | NA | T | 4.09E+04 |
| Hexanal | 66-25-1 | NA | | NA | | NA | NA | NA | NA | | |
| 3-Furaldehyde | 498-60-2 | NA | | NA | | NA | NA | NA | NA | | |
| 2-Cyclopenten-1-one | 930-30-3 | NA | | NA | | NA | NA | NA | NA | | |
| 2-Furaldehyde | 98-01-1 | 5.20E+01 | nc | 3.65E+01 | nc | 5.20E+01 | NA | 7.86E+03 | NA | T | 7.86E+03 |

Appendix C: Health-Based Screening Levels and Acute Toxicity Values

| Compound | CAS # | For the Chronic Evaluation (HBSL) | | | | | For the Acute Evaluation (ATV) | | | | |
|-------------------------------|------------|---|-----------------------------------|---|-----------------------------------|---|--------------------------------------|--------------------------------------|--------------------------------------|-----------------------|---|
| | | Region 9 PRG ($\mu\text{g}/\text{m}^3$) | Toxicity Endpoint (c or nc) | Region 3 RBC ($\mu\text{g}/\text{m}^3$) | Toxicity Endpoint (c or nc) | Health-based Screening Level ($\mu\text{g}/\text{m}^3$) | ERPG ($\mu\text{g}/\text{m}^3$) | TEEL ($\mu\text{g}/\text{m}^3$) | AEGL ($\mu\text{g}/\text{m}^3$) | Source (A, E or T) | Acute Toxicity Value ($\mu\text{g}/\text{m}^3$) |
| 1-Acetoxycetone | 592-20-1 | NA | | NA | | NA | NA | NA | NA | | |
| 2-Heptanone | 110-43-0 | NA | | NA | | NA | NA | 7.01E+05 | NA | T | 7.01E+05 |
| Heptanal | 66-25-1 | NA | | NA | | NA | NA | NA | NA | | |
| 5-Methyl-2-furaldehyde | 620-02-0 | NA | | NA | | NA | NA | NA | NA | | |
| Benzaldehyde | 100-52-7 | 3.65E+02 | nc | 3.65E+02 | nc | 3.65E+02 | NA | 1.50E+04 | NA | T | 1.50E+04 |
| Benzofuran | 271-89-6 | NA | | NA | | NA | NA | NA | NA | | |
| Octanal | 124-13-0 | NA | | NA | | NA | NA | NA | NA | | |
| Acetophenone | 98-86-2 | 2.10E-02 | nc | 2.08E-02 | nc | 2.10E-02 | NA | 3.00E+04 | NA | T | 3.00E+04 |
| 2-Nonanone | 821-55-6 | NA | | NA | | NA | NA | NA | NA | | |
| Nonanal | 124-19-6 | NA | | NA | | NA | NA | NA | NA | | |
| N-Nitrosodimethylamine | 62-75-9 | 1.40E-04 | c | 1.23E-04 | c | 1.40E-04 | NA | 2.50E+03 | NA | T | 2.50E+03 |
| Pyridine | 110-86-1 | 3.65E+00 | nc | 3.65E+00 | nc | 3.65E+00 | NA | 4.85E+04 | NA | T | 4.85E+04 |
| 2-Picoline | 109-06-8 | NA | | NA | | NA | NA | NA | NA | | |
| Methyl methanesulfonate | 66-27-3 | NA | | NA | | NA | NA | NA | NA | | |
| N-Nitrosomethylethylamine | 10595-95-6 | 3.06E-04 | c | 2.85E-04 | c | 3.06E-04 | NA | NA | NA | | |
| N-Nitrosodiethylamine | 55-18-5 | 4.47E-05 | c | 4.17E-05 | c | 4.47E-05 | NA | NA | NA | | |
| Ethyl methanesulfonate | 62-50-0 | NA | | NA | | NA | NA | NA | NA | | |
| Phenol | 108-95-2 | 2.19E+03 | nc | 2.19E+03 | nc | 2.19E+03 | 3.85E+05 | 3.85E+04 | NA | E | 3.85E+05 |
| Aniline | 62-53-3 | NA | | 1.06E+00 | nc | 1.06E+00 | NA | 2.29E+04 | 3.00E+04 | A | 3.00E+04 |
| bis(2-Chloroethyl)ether | 111-44-4 | 5.80E-03 | c | 5.69E-03 | c | 5.80E-03 | NA | 5.85E+04 | NA | T | 5.85E+04 |
| Pentachloroethane | 76-01-7 | NA | | NA | | NA | NA | 3.00E+04 | NA | T | 3.00E+04 |
| 2-Chlorophenol | 95-57-8 | 1.83E+01 | nc | 1.83E+01 | nc | 1.83E+01 | NA | 5.25E+03 | NA | T | 5.25E+03 |
| 1,3-Dichlorobenzene | 543-73-1 | NA | | NA | | NA | NA | NA | NA | | |
| 1,4-Dichlorobenzene | 106-46-7 | 2.80E-01 | c | 2.85E-01 | c | 2.80E-01 | NA | 6.61E+05 | NA | T | 6.61E+05 |
| Benzyl alcohol | 100-51-6 | 1.10E+03 | nc | 1.10E+03 | nc | 1.10E+03 | NA | 5.53E+04 | NA | T | 5.53E+04 |
| 2-Methylphenol | 95-48-7 | 1.83E+02 | nc | 1.83E+02 | nc | 1.83E+02 | NA | 6.63E+04 | NA | T | 6.63E+04 |
| 1,2-Dichlorobenzene | 95-50-1 | 2.09E+02 | nc | 3.29E+01 | nc | 2.09E+02 | NA | 3.01E+05 | NA | T | 3.01E+05 |
| bis(2-Chloroisopropyl)ether | 108-60-1 | 1.92E-01 | c | 1.79E-01 | c | 1.92E-01 | NA | 6.99E+04 | NA | T | 6.99E+04 |
| o-Toluidine | 95-53-4 | 2.80E-02 | c | 2.61E-02 | c | 2.80E-02 | NA | 2.63E+04 | NA | T | 2.63E+04 |
| 4-Methylphenol/3-Methylphenol | 1319-77-3 | 1.83E+01 | nc | 1.83E+01 | nc | 1.83E+01 | NA | 6.63E+04 | NA | T | 6.63E+04 |
| N-Nitroso-di-n-propylamine | 621-64-7 | 9.61E-04 | c | 8.94E-04 | c | 9.61E-04 | NA | 2.00E+02 | NA | T | 2.00E+02 |
| Acetophenone | 98-86-2 | 2.10E-02 | nc | 2.08E-02 | nc | 2.10E-02 | NA | 3.00E+04 | NA | T | 3.00E+04 |
| N-Nitrosomorpholine | 59-89-2 | NA | | NA | | NA | NA | 3.00E+04 | NA | T | 3.00E+04 |
| N-Nitrosopyrrolidine | 930-55-2 | 3.15E-03 | c | 2.98E-03 | c | 3.15E-03 | NA | NA | NA | | |
| Hexachloroethane | 67-72-1 | 4.80E-01 | c | 4.47E-01 | c | 4.80E-01 | NA | 2.90E+04 | NA | T | 2.90E+04 |
| Nitrobenzene | 98-95-3 | 2.09E+00 | nc | 2.19E+00 | nc | 2.09E+00 | NA | 1.51E+04 | NA | T | 1.51E+04 |

Appendix C: Health-Based Screening Levels and Acute Toxicity Values

| Chemical Compound | CAS # | For the Chronic Evaluation (HBSL) | | | | | For the Acute Evaluation (ATV) | | | | |
|----------------------------|------------|-----------------------------------|-----------------------------------|----------------------------|-----------------------------------|---|--------------------------------|----------------|----------------|----------------------|-----------------------------------|
| | | Region 9 PRG (pg/m) | Toxicity Endpoint (c or mg) | Region 3 RBC (pg/ml) | Toxicity Endpoint (c or mg) | Health-Based Screening Level (pg/m) | ERPG (pg/m) | TEEL (pg/m) | AECI (pg/m) | Source (A/E or T) | Acute Toxicity Value (pg/m) |
| N-Nitrosopiperidine | 100-75-4 | NA | | NA | | NA | NA | NA | NA | | |
| Isophorone | 78-59-1 | 7.08E+00 | c | 6.59E+00 | | 7.08E+00 | NA | 2.83E+04 | NA | T | 2.83E+04 |
| 2,4-Dimethylphenol | 105-67-9 | 7.30E+01 | nc | 7.30E+01 | nc | 7.30E+01 | NA | NA | NA | | |
| 2-Nitrophenol | 88-75-5 | NA | | NA | | NA | NA | NA | NA | | |
| bis(2-Chloroethoxy)methane | 111-91-1 | NA | | NA | | NA | NA | NA | NA | | |
| Benzoic acid | 65-85-0 | 1.50E+04 | nc | 1.46E+04 | nc | 1.50E+04 | NA | 1.25E+04 | NA | T | 1.25E+04 |
| 2,4-Dichlorophenol | 120-83-2 | 1.10E+01 | nc | 1.10E+01 | nc | 1.10E+01 | NA | 3.00E+04 | NA | T | 3.00E+04 |
| 1,2,4-Trichlorobenzene | 120-82-1 | 2.08E+02 | nc | 2.08E+02 | nc | 2.08E+02 | NA | 3.71E+04 | NA | T | 3.71E+04 |
| Naphthalene | 91-20-3 | 3.13E+00 | nc | 3.29E+00 | nc | 3.13E+00 | NA | 7.86E+04 | NA | T | 7.86E+04 |
| p-Chloroaniline | 106-47-8 | 1.46E+01 | nc | 1.46E+01 | nc | 1.46E+01 | NA | 3.00E+04 | NA | T | 3.00E+04 |
| 2,6-Dichlorophenol | 87-65-0 | NA | | NA | | NA | NA | 3.00E+04 | NA | T | 3.00E+04 |
| Hexachloropropene | 1888-71-7 | NA | | NA | | NA | NA | NA | NA | | |
| Hexachlorobutadiene | 87-68-3 | 8.62E-02 | c | 8.03E-02 | c | 8.62E-02 | 3.21E+04 | 3.20E+04 | NA | E | 3.21E+04 |
| Dimethylphenethylamine | 122-09-8 | 3.65E+00 | nc | NA | | 3.65E+00 | NA | NA | NA | | |
| N-Nitroso-di-n-butylamine | 924-16-3 | 1.20E-03 | c | 1.12E-03 | c | 1.20E-03 | NA | NA | NA | | |
| 4-Chloro-3-methylphenol | 35421-08-0 | NA | | NA | | NA | NA | NA | NA | | |
| Satrole | 94-59-7 | NA | | NA | | NA | NA | NA | NA | | |
| 2-Methylnaphthalene | 91-57-6 | NA | | NA | | NA | NA | NA | NA | | |
| 1,2,4,5-Tetrachlorobenzene | 95-94-3 | 1.10E+00 | nc | 1.10E+00 | nc | 1.10E+00 | NA | 2.00E+04 | NA | T | 2.00E+04 |
| Hexachlorocyclopentadiene | 77-47-4 | 7.30E-02 | nc | 7.30E-02 | nc | 7.30E-02 | NA | 3.00E+04 | NA | T | 3.00E+04 |
| 2,4,6-Trichlorophenol | 88-06-2 | 6.20E-01 | c | 6.26E-01 | c | 6.20E-01 | NA | 2.23E+02 | NA | T | 2.23E+02 |
| 2,4,5-Trichlorophenol | 95-95-4 | 3.65E+02 | nc | 3.65E+02 | nc | 3.65E+02 | NA | 3.00E+04 | NA | T | 3.00E+04 |
| Isosafrole | 120-58-1 | NA | | NA | | NA | NA | 3.00E+04 | NA | T | 3.00E+04 |
| 2-Chloronaphthalene | 91-58-7 | 2.92E+02 | nc | 2.92E+02 | nc | 2.92E+02 | NA | NA | NA | | |
| 2-Nitroaniline | 88-74-4 | 2.09E-01 | nc | 2.08E-01 | nc | 2.09E-01 | NA | 6.00E+02 | NA | T | 6.00E+02 |
| 1,4-Naphthoquinone | 130-15-4 | NA | | NA | | NA | NA | NA | NA | | |
| Dimethylphthalate | 131-11-3 | 3.65E+04 | nc | 3.65E+04 | nc | 3.65E+04 | NA | 2.50E+02 | NA | T | 2.50E+02 |
| 1,3-Dinitrobenzene | 99-65-0 | 3.65E-01 | nc | 3.65E-01 | nc | 3.65E-01 | NA | 1.50E+04 | NA | T | 1.50E+04 |
| 2,6-Dinitrotoluene | 606-20-2 | 3.65E+00 | nc | 3.65E+00 | nc | 3.65E+00 | NA | 3.00E+03 | NA | T | 3.00E+03 |
| Acenaphthylene | 208-96-8 | NA | | NA | | NA | NA | 6.00E+02 | NA | T | 6.00E+02 |
| 3-Nitroaniline | 99-09-2 | NA | | NA | | NA | NA | 2.00E+02 | NA | T | 2.00E+02 |
| 4-Nitrophenol | 100-02-7 | 2.90E+01 | nc | 2.92E+01 | nc | 2.90E+01 | NA | NA | NA | | |
| 2,4-Dinitrophenol | 51-28-5 | 7.30E+00 | nc | 7.30E+00 | nc | 7.30E+00 | NA | 3.00E+04 | NA | T | 3.00E+04 |
| Acenaphthene | 83-32-9 | 2.19E+02 | nc | 2.19E+02 | nc | 2.19E+02 | NA | 7.50E+03 | NA | T | 7.50E+03 |
| 2,4-Dinitrotoluene | 121-14-2 | 7.30E+00 | nc | 7.30E+00 | nc | 7.30E+00 | NA | 1.25E+03 | NA | T | 1.25E+03 |
| Dibenzofuran | 132-64-9 | 1.46E+01 | nc | 1.46E+01 | nc | 1.46E+01 | NA | 6.00E+02 | NA | T | 6.00E+02 |
| | | | | | | | NA | 1.50E+00 | NA | T | 1.50E+00 |

Appendix C: Health-Based Screening Levels and Acute Toxicity Values

| Compound | CAS # | For the Chronic Evaluation (HBSL) | | | | | For the Acute Evaluation (ATV) | | | | |
|----------------------------|------------|---|-----------------------------------|---|-----------------------------------|---|--------------------------------|------------------------------|------------------------------|----------------------|---|
| | | Region 9 PRG (µg/m ³) | Toxicity Endpoint (c or nc) | Region 3 RBC (µg/m ³) | Toxicity Endpoint (c or nc) | Health-based Screening Level (µg/m ³) | ERPG (µg/m ³) | TEEL (µg/m ³) | AEGL (µg/m ³) | Source (A/E or T) | Acute Toxicity Value (µg/m ³) |
| Pentachlorobenzene | 608-93-5 | 2.92E+00 | nc | 2.92E+00 | nc | 2.92E+00 | NA | 3.00E+04 | NA | T | 3.00E+04 |
| 1-Naphthylamine | 134-32-7 | NA | | NA | | NA | NA | 3.50E+04 | NA | T | 3.50E+04 |
| 2-Naphthylamine | 91-59-8 | NA | | NA | | NA | NA | 7.50E+03 | NA | T | 7.50E+03 |
| 2,3,4,6-Tetrachlorophenol | 58-90-2 | 1.10E+02 | nc | 1.10E+02 | nc | 1.10E+02 | NA | NA | NA | | |
| Diethylphthalate | 84-66-2 | 2.92E+03 | nc | 2.92E+03 | nc | 2.92E+03 | NA | 1.50E+04 | NA | T | 1.50E+04 |
| 4-Chlorophenylphenyl ether | 7005-72-3 | NA | | NA | | NA | NA | NA | NA | | |
| Fluorene | 86-73-7 | 1.46E+02 | nc | 1.46E+02 | nc | 1.46E+02 | NA | 7.50E+04 | NA | T | 7.50E+04 |
| 5-Nitro-o-toluidine | 99-55-8 | 2.00E-01 | c | 1.90E-01 | c | 2.00E-01 | NA | NA | NA | | |
| 4-Nitroaniline | 100-01-6 | NA | | NA | | NA | NA | 9.00E+03 | NA | T | 9.00E+03 |
| 4,6-Dinitro-2-methylphenol | 534-52-1 | NA | | 3.65E-01 | nc | 3.65E-01 | NA | 5.00E+02 | NA | T | 5.00E+02 |
| Diphenylamine/N-NitrosodPA | 62-75-9 | 1.37E-04 | c | 1.23E-04 | c | 1.37E-04 | NA | 2.50E+03 | NA | T | 2.50E+03 |
| sym-Trinitrobenzene | 99-35-4 | 1.10E+02 | nc | 1.10E+02 | nc | 1.10E+02 | NA | 3.00E+04 | NA | T | 3.00E+04 |
| Diallate | 2303-16-4 | 1.10E-01 | c | NA | | 1.10E-01 | NA | NA | NA | | |
| Phenacetin | 62-44-2 | NA | | NA | | NA | NA | 3.00E+04 | NA | T | 3.00E+04 |
| 4-Bromophenylphenyl ether | 101-55-3 | NA | | NA | | NA | NA | NA | NA | | |
| Hexachlorobenzene | 118-74-1 | 4.18E-03 | c | 3.91E-03 | c | 4.18E-03 | NA | 7.50E+01 | NA | T | 7.50E+01 |
| 4-Aminobiphenyl | 92-67-1 | NA | | NA | | NA | NA | 1.50E+03 | NA | T | 1.50E+03 |
| Pronamide | 23950-58-5 | 2.74E+02 | nc | NA | | 2.74E+02 | NA | NA | NA | | |
| Pentachlorophenol | 87-86-5 | 5.60E-02 | c | 5.22E-02 | c | 5.60E-02 | NA | 1.50E+03 | NA | T | 1.50E+03 |
| Pentachloronitrobenzene | 82-69-8 | 2.59E-02 | c | 2.41E-02 | c | 2.59E-02 | NA | 1.50E+03 | NA | T | 1.50E+03 |
| Phenanthrene | 85-01-8 | NA | | NA | | NA | NA | 2.00E+03 | NA | T | 2.00E+03 |
| Anthracene | 120-12-7 | 1.10E+03 | nc | 1.10E+03 | nc | 1.10E+03 | NA | 6.00E+03 | NA | T | 6.00E+03 |
| Carbazole | 86-74-8 | 3.36E-01 | c | 3.13E-01 | c | 3.36E-01 | NA | NA | NA | | |
| Di-n-butylphthalate | 84-74-2 | 3.65E+02 | nc | 3.65E+02 | nc | 3.65E+02 | NA | 1.50E+04 | NA | T | 1.50E+04 |
| 4-Nitroquinoline-1-oxide | 56-57-5 | NA | | NA | | NA | NA | NA | NA | | |
| Methapyrene | 91-80-5 | NA | | NA | | NA | NA | NA | NA | | |
| Fluoranthene | 206-44-0 | 1.46E+02 | nc | 1.46E+02 | nc | 1.46E+02 | NA | 3.00E+01 | NA | T | 3.00E+01 |
| Benzidine | 92-87-5 | 2.90E-05 | c | 2.90E+00 | c | 2.90E-05 | NA | 5.00E+02 | NA | T | 5.00E+02 |
| Pyrene | 129-00-0 | 1.10E+02 | nc | 1.10E+02 | nc | 1.10E+02 | NA | 1.50E+04 | NA | T | 1.50E+04 |
| p-Dimethylaminoazobenzene | 60-11-7 | NA | | NA | | NA | NA | 7.50E+04 | NA | T | 7.50E+04 |
| Chlorobenzilate | 510-15-6 | 2.49E-02 | c | 2.32E-02 | c | 2.49E-02 | NA | 2.50E+02 | NA | T | 2.50E+02 |
| Kepon | 143-50-0 | 3.74E-04 | c | NA | | 3.74E-04 | NA | 1.00E+02 | NA | T | 1.00E+02 |
| Butylbenzylphthalate | 85-68-7 | 7.30E+02 | nc | 7.30E+02 | nc | 7.30E+02 | NA | 5.00E+05 | NA | T | 5.00E+05 |
| 3,3'-Dimethylbenzidine | 119-93-7 | 7.30E-04 | c | 6.81E-04 | c | 7.30E-04 | NA | 3.00E+00 | NA | T | 3.00E+00 |
| 2-Acetylaminofluorene | 53-96-3 | NA | | NA | | NA | NA | 2.50E+03 | NA | T | 2.50E+03 |
| bis(2-Ethylhexyl)phthalate | 117-81-7 | 4.80E-01 | c | 4.47E-01 | c | 4.80E-01 | NA | 1.00E+04 | NA | T | 1.00E+04 |

Appendix C: Health-Based Screening Levels and Acute Toxicity Values

| Compound | | CAS # | For the Chronic Evaluation (HBSL) | | | | | For the Acute Evaluation (ATV) | | | | |
|--|------------|-------|-----------------------------------|--------------------------|----------------------|--------------------------|--------------------------------------|--------------------------------|--------------|--------------|------------------------------|----------|
| | | | Region 9 PRG (µg/m³) | Toxicity Endpoint (C/m³) | Region 9 RBC (µg/m³) | Toxicity Endpoint (C/m³) | Health-based Screening Level (µg/m³) | TEEL (µg/m³) | AEGL (µg/m³) | Source (NEC) | Acute Toxicity Value (µg/m³) | |
| 3,3'-Dichlorobenzidine | 91-94-1 | | 1.50E-02 | c | 1.39E-02 | c | 1.50E-02 | NA | 6.21E+03 | NA | T | 6.21E+03 |
| Benz(a)anthracene | 56-55-3 | | 2.17E-02 | c | 8.58E-03 | c | 2.17E-02 | NA | 6.00E+02 | NA | T | 6.00E+02 |
| Chrysene | 218-01-9 | | 2.17E+00 | c | 8.58E-01 | c | 2.17E+00 | NA | 2.00E+02 | NA | T | 2.00E+02 |
| Di-n-octylphthalate | 117-84-0 | | 7.30E+01 | nc | 7.30E+01 | nc | 7.30E+01 | NA | 1.50E+05 | NA | T | 1.50E+05 |
| 7,12-Dimethylbenz(a)anthracene | 57-97-6 | | NA | | NA | | NA | NA | NA | NA | | |
| Benzo(b)fluoranthene | 205-99-2 | | 2.17E-02 | c | 8.58E-03 | c | 2.17E-02 | NA | NA | NA | | |
| Benzo(k)fluoranthene | 207-08-9 | | 2.17E-01 | c | 8.58E-02 | c | 2.17E-01 | NA | NA | NA | | |
| Benzo(a)pyrene | 50-32-8 | | 2.17E-03 | c | 2.02E-03 | c | 2.17E-03 | NA | 7.50E+03 | NA | T | 7.50E+03 |
| 3-Methylcholanthrene | 56-49-5 | | NA | | NA | | NA | NA | 1.50E+03 | NA | T | 1.50E+03 |
| Indeno(1,2,3-cd)pyrene | 193-39-5 | | 2.17E-02 | c | 8.58E-03 | c | 2.17E-02 | NA | NA | NA | | |
| Dibenz(a,h)anthracene | 53-70-3 | | 2.17E-03 | c | 8.58E-04 | c | 2.17E-03 | NA | 3.00E+04 | NA | T | 3.00E+04 |
| Benzo(g,h,i)perylene | 191-24-2 | | NA | | NA | | NA | NA | 3.00E+04 | NA | T | 3.00E+04 |
| 2-(2-quinoliny)-(H)-indene-1,3-(2H)-dione | | | NA | | NA | | NA | NA | NA | NA | | |
| Benzanthrone | 82-05-3 | | NA | | NA | | NA | NA | NA | NA | | |
| Tetrachloroethene | 127-18-4 | | 3.31E+00 | c | 3.13E+00 | c | 3.31E+00 | NA | 6.78E+05 | NA | T | 6.78E+05 |
| (1,2-dichloroethyl)-benzene | 1074-11-9 | | NA | | NA | | NA | NA | NA | NA | | |
| 4-phenoxy-2(1H)-quinolinone | 66662-28-0 | | NA | | NA | | NA | NA | NA | NA | | |
| 3-(phenylhydrazono)-1H-Indole-2,3-dione | | | NA | | NA | | NA | NA | NA | NA | | |
| 4-1,2,4-oxadiazolin-3-one-2,5-diphenyl-delta | | | NA | | NA | | NA | NA | NA | NA | | |
| 2-amino-9,10-anthracenedione | 117-79-3 | | NA | | NA | | NA | NA | NA | NA | | |

Footnotes:

PRG: Preliminary Remediation Goals
c: Cancer
nc: non-cancer
RBC: Risk-Based Concentration
HBSL: Health-based Screening Level
(E) ERPG: Emergency Response Planning Guidelines
(T) TEEL: Temporary Emergency Exposure Limits
ATV: Acute Toxicity Value
NA: Not available

APPENDIX D
RISK EVALUATION DATA

Table D-1: Comparison of Air Concentrations With Health-Based Values: Metals, Particulates and Miscellaneous Compounds

| Compound | Violet Smoke Grenade | | | | | | |
|---------------------|---|---|----------------------------|------|---|---|-------------------------|
| | C _{chronic} (µg/m ³) | Health-Based Screening Level (µg/m ³) | C _{chronic} /HBSL | > 1? | C _{acute} (µg/m ³) | Acute Toxicity Value (µg/m ³) | C _{acute} /ATV |
| TSP | 1.11E+00 | 5.00E+01 | 2.21E-02 | no | 1.16E+03 | NV | na |
| HCl (a) | NA | 2.08E+01 | | na | NA | 4.47E+03 | na |
| Cl ₂ (a) | 1.55E-05 | 2.09E-01 | 7.44E-05 | no | 1.63E-02 | 2.90E+03 | 5.63E-06 |
| Dioxin TEQ (b) | 4.85E-11 | 4.48E-08 | 1.08E-03 | no | 4.76E-07 | 3.50E+00 | 1.36E-07 |
| Carbon Monoxide | 1.29E-01 | 1.57E+02 | 8.19E-04 | no | 1.35E+02 | 2.30E+05 | 5.88E-04 |
| Nitrogen Oxide | 4.64E-03 | 1.00E+02 | 4.64E-05 | no | 1.95E+01 | 2.70E+05 | 7.22E-05 |
| HCl (a) | 4.43E-04 | 2.08E+01 | 2.12E-05 | no | 1.86E+00 | 4.47E+03 | 4.16E-04 |
| Carbon Dioxide | 4.07E-01 | NV | | na | 1.71E+03 | 5.40E+07 | 3.17E-05 |
| Sulfur Dioxide | 1.55E-03 | 8.00E+01 | 1.93E-05 | no | 1.62E+00 | 7.89E+02 | 2.06E-03 |
| Aluminum | 3.97E-04 | 3.65E+00 | 1.09E-04 | no | 1.67E+00 | 3.00E+04 | 5.57E-05 |
| Antimony | NA | 1.46E+00 | | na | NA | 1.50E+03 | na |
| Arsenic | NA | 4.47E-04 | | na | NA | 3.00E+01 | na |
| Barium | 6.84E-06 | 5.21E-01 | 1.31E-05 | no | 2.88E-02 | 1.50E+03 | 1.92E-05 |
| Beryllium | NA | 8.00E-04 | | na | NA | 5.00E+00 | na |
| Cadmium | NA | 1.07E-03 | | na | NA | 3.00E+01 | na |
| Chromium | 1.24E-06 | 1.53E-04 | 8.10E-03 | no | 1.21E-02 | 1.50E+03 | 8.09E-06 |
| Cobalt | NA | 2.20E+02 | | na | NA | 6.00E+01 | na |
| Copper | NA | 1.46E+02 | | na | NA | 3.00E+03 | na |
| Lead | 1.52E-04 | 1.50E+00 | 1.01E-04 | no | 6.40E-01 | 1.50E+02 | 4.26E-03 |
| Magnesium | 5.44E-05 | NV | | na | 2.29E-01 | 3.00E+04 | 7.63E-06 |
| Manganese | 1.00E-05 | 5.11E-02 | 1.96E-04 | no | 4.21E-02 | 3.00E+03 | 1.40E-05 |
| Nickel | 1.99E-06 | 7.30E+01 | 2.72E-08 | no | 8.36E-03 | 3.00E+03 | 2.79E-06 |
| Phosphorus | NA | NV | | na | NA | 3.00E+02 | na |
| Selenium | NA | 1.83E+01 | | na | NA | 6.00E+02 | na |
| Silver | NA | 1.83E+01 | | na | NA | 3.00E+02 | na |
| Thallium | NA | 2.56E-01 | | na | NA | 3.00E+02 | na |
| Zinc | 2.04E-05 | 1.10E+03 | 1.87E-08 | no | 8.59E-02 | 3.00E+04 | 2.86E-06 |
| Mercury | 1.17E-13 | 3.13E-01 | 3.73E-13 | no | 4.90E-04 | 1.00E+02 | 4.90E-06 |

Footnote:

(a) HCl/Cl₂ levels were too low to be reliably measured.

(b) Presence questionable - reported at similar levels in samples and blanks.

NA = Not applicable because compound was not detected.

na = Not available because health-based screening value is not available or not applicable if compound was not detected.

NV = No value

C_{chronic} = Chronic time-averaged concentration; HBSL = Chronic health-based screening level

C_{acute} = Acute concentration; ATV = Acute toxicity value

Table D-2: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds

| Compound (a) | Violet Smoke Grenade | | | | | | |
|---------------------------------------|---|---|----------------------------|------|---|---|-------------------------|
| | C _{chronic} (µg/m ³) | Health-Based Screening Level (µg/m ³) | C _{chronic} /HBSL | > 1? | C _{acute} (µg/m ³) | Acute Toxicity Value (µg/m ³) | C _{acute} /ATV |
| Total Nonmethane Hydrocarbons (TNMHC) | | | | | | | |
| TNMHC | 1.07E-02 | NV | | na | 1.12E+01 | NV | na |
| Volatile Organic Compounds (VOCs) | | | | | | | |
| Ethane | 1.08E-04 | NV | | na | 1.14E-01 | NV | na |
| Ethylene | 2.88E-03 | NV | | na | 1.21E+01 | 4.60E+05 | 2.63E-05 |
| Acetylene | 1.49E-03 | NV | | na | 1.57E+00 | NV | na |
| Propane | 3.13E-05 | NV | | na | 1.32E-01 | 3.78E+06 | 3.49E-08 |
| Propene | 4.10E-04 | NV | | na | 4.31E-01 | NV | na |
| i-Butane | 1.99E-06 | NV | | na | 8.37E-03 | 5.71E+06 | 1.47E-09 |
| i-Butene | 4.18E-05 | NV | | na | 4.40E-02 | NV | na |
| 1-Butene | 9.82E-05 | NV | | na | 1.03E-01 | NV | na |
| 1,3-Butadiene | 4.88E-05 | 3.74E-03 | 1.31E-02 | no | 1.20E-01 | 2.20E+04 | 5.45E-06 |
| n-Butane | 9.96E-06 | NV | | na | 4.19E-02 | 5.71E+06 | 7.33E-09 |
| trans-2-Butene | 6.86E-05 | NV | | na | 7.21E-02 | NV | na |
| 2,2-Dimethylpropane | NA | NV | | na | NA | NV | na |
| cis-2-Butene | 1.24E-05 | NV | | na | 1.30E-02 | NV | na |
| 3-Methyl-1-butene | 8.19E-06 | NV | | na | 8.61E-03 | NV | na |
| i-Pentane | NA | NV | | na | NA | 1.80E+06 | na |
| 1-Pentene | 4.76E-05 | NV | | na | 5.00E-02 | NV | na |
| 2-Methyl-1-butene | 1.15E-05 | NV | | na | 1.21E-02 | NV | na |
| n-Pentane | NA | NV | | na | NA | 1.80E+06 | na |
| Isoprene | NA | NV | | na | NA | NV | na |
| trans-2-Pentene | NA | NV | | na | NA | NV | na |
| cis-2-Pentene | NA | NV | | na | NA | NV | na |
| 2-Methyl-2-butene | NA | NV | | na | NA | NV | na |
| 2,2-Dimethylbutane | NA | NV | | na | NA | 1.80E+06 | na |
| Cyclopentene | NA | NV | | na | NA | NV | na |
| 4-Methyl-1-pentene | NA | NV | | na | NA | NV | na |
| Cyclopentane | NA | NV | | na | NA | NV | na |

Table D-2: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds

| Violet Smoke Grenade | | | | | | | | |
|---------------------------|---|---|----------------------------|------|---|---|-------------------------|------|
| Compound (a) | C _{chronic} (µg/m ³) | Health-Based Screening Level (µg/m ³) | C _{chronic} /HBSL | > 1? | C _{acute} (µg/m ³) | Acute Toxicity Value (µg/m ³) | C _{acute} /ATV | > 1? |
| 2,3-Dimethylbutane | NA | NV | | na | NA | NV | | na |
| cis-4-Methyl-2-pentene | NA | NV | | na | NA | NV | | na |
| 2-Methylpentane | NA | NV | | na | NA | 1.80E+06 | | na |
| 3-Methylpentane | NA | NV | | na | NA | NV | | na |
| 2-Methyl-1-pentene | NA | NV | | na | NA | NV | | na |
| 1-Hexene | 6.77E-05 | NV | | na | 2.85E-01 | 1.03E+05 | 2.76E-06 | no |
| n-Hexane | NA | 2.10E+02 | | na | NA | 5.28E+05 | | na |
| trans-2-Hexene | NA | NV | | na | NA | NV | | na |
| 2-Methyl-2-pentene | NA | NV | | na | NA | NV | | na |
| cis-2-Hexene | NA | NV | | na | NA | NV | | na |
| Methylcyclopentane | NA | NV | | na | NA | NV | | na |
| 2,4-Dimethylpentane | NA | NV | | na | NA | NV | | na |
| Benzene | 3.24E-04 | 2.50E-01 | 1.30E-03 | no | 7.96E-01 | 1.56E+05 | 5.10E-06 | no |
| Cyclohexane | NA | NV | | na | NA | 3.10E+06 | | na |
| 2-Methylhexane | NA | NV | | na | NA | NV | | na |
| 2,3-Dimethylpentane | NA | NV | | na | NA | NV | | na |
| 3-Methylhexane | NA | NV | | na | NA | NV | | na |
| 2,2,4-Trimethylpentane | NA | NV | | na | NA | 3.50E+05 | | na |
| n-Heptane | NA | NV | | na | NA | 1.80E+06 | | na |
| 2,4,4-Trimethyl-1-pentene | NA | NV | | na | NA | NV | | na |
| Methylcyclohexane | NA | 3.10E+03 | | na | NA | 4.81E+06 | | na |
| 2,4,4-Trimethyl-2-pentene | NA | NV | | na | NA | NV | | na |
| 2,5-Dimethylhexane | NA | NV | | na | NA | NV | | na |
| 2,4-Dimethylhexane | NA | NV | | na | NA | NV | | na |
| 2,3,4-Trimethylpentane | NA | NV | | na | NA | NV | | na |
| Toluene | 8.67E-05 | 4.02E+02 | 2.16E-07 | no | 9.11E-02 | 1.88E+05 | 4.86E-07 | no |
| 2,3-Dimethylhexane | NA | NV | | na | NA | NV | | na |
| 2-Methylheptane | NA | NV | | na | NA | NV | | na |
| 3-Ethylhexane | NA | NV | | na | NA | NV | | na |
| 2,2-Dimethylheptane | NA | NV | | na | NA | NV | | na |

Table D-2: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds

| Compound (a) | Violet Smoke Grenade | | | | | | |
|---|---|---|----------------------------|------|---|---|-------------------------|
| | C _{chronic} (µg/m ³) | Health-Based Screening Level (µg/m ³) | C _{chronic} /HBSL | > 1? | C _{acute} (µg/m ³) | Acute Toxicity Value (µg/m ³) | C _{acute} /ATV |
| 2,2,4-Trimethylhexane | NA | NV | | na | NA | NV | na |
| n-Octane | NA | NV | | na | NA | NV | na |
| Ethylcyclohexane | NA | NV | | na | NA | NV | na |
| Ethylbenzene | 6.33E-06 | 1.10E+03 | 5.75E-09 | no | 2.66E-02 | 5.43E+05 | 4.91E-08 |
| m-Xylene & p-Xylene | 8.05E-06 | NV | | na | 3.39E-02 | 6.51E+05 | 5.20E-08 |
| Styrene | NA | 1.10E+03 | | na | NA | 2.13E+05 | na |
| o-Xylene | 8.67E-06 | 7.30E+02 | 1.19E-08 | no | 3.65E-02 | 6.51E+05 | 5.60E-08 |
| n-Nonane | NA | 4.02E+02 | | na | NA | 1.05E+06 | na |
| i-Propylbenzene | NA | 4.00E+02 | | na | NA | 7.37E+05 | na |
| n-Propylbenzene | NA | 3.65E+01 | | na | NA | 3.68E+05 | na |
| p-Ethyltoluene | NA | NV | | na | NA | 1.25E+05 | na |
| m-Ethyltoluene | NA | NV | | na | NA | NV | na |
| 1,3,5-Trimethylbenzene | NA | 6.20E+00 | | na | NA | 3.68E+05 | na |
| o-Ethyltoluene | NA | NV | | na | NA | 7.50E+02 | na |
| 1,2,4-Trimethylbenzene & sec-Butylbenzene | NA | 6.21E+00 | | na | NA | 1.80E+05 | na |
| n-Decane | NA | NV | | na | NA | 4.37E+03 | na |
| alpha-Pinene | NA | NV | | na | NA | 4.00E+04 | na |
| beta-Pinene | NA | NV | | na | NA | NV | na |
| delta 3-Carene | NA | NV | | na | NA | NV | na |
| d-Limonene | NA | NV | | na | NA | 3.50E+05 | na |
| MTBE | NA | 3.10E+03 | | na | NA | 4.32E+05 | na |
| Dichlorodifluoromethane | 4.56E-07 | 2.10E+02 | 2.17E-09 | no | 1.92E-03 | 1.48E+07 | 1.29E-10 |
| Methylchloride | NA | 1.07E+00 | | na | NA | NV | na |
| Dichlorotetrafluoroethane | NA | NV | | na | NA | NV | na |
| Chloroethene | 1.10E-05 | 2.20E-02 | 5.00E-04 | no | 1.08E-01 | 1.28E+04 | 8.47E-06 |
| 1,3-Butadiene | 4.97E-05 | 3.74E-03 | 1.33E-02 | no | 1.22E-01 | 2.20E+04 | 5.54E-06 |
| Methylbromide | NA | 5.20E+00 | | na | NA | 5.82E+04 | na |
| Ethylchloride | 8.29E-07 | 2.30E+00 | 3.60E-07 | no | 8.13E-03 | 7.92E+06 | 1.03E-09 |
| Trichloromonofluoromethane | NA | 7.30E+02 | | na | NA | 2.81E+06 | na |

Table D-2: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds

| Compound (a) | Violet Smoke Grenade | | | | | | | |
|---------------------------------------|---|---|----------------------------|------|---|---|-------------------------|------|
| | C _{chronic} (µg/m ³) | Health-Based Screening Level (µg/m ³) | C _{chronic} /HBSL | > 1? | C _{acute} (µg/m ³) | Acute Toxicity Value (µg/m ³) | C _{acute} /ATV | > 1? |
| Vinylidenechloride | 9.85E-07 | 5.26E+08 | 1.87E-15 | no | 9.66E-03 | 7.92E+04 | 1.22E-07 | no |
| Methylenechloride | 8.01E-06 | 4.10E+00 | 1.95E-06 | no | 1.97E-02 | 6.96E+05 | 2.82E-08 | no |
| Allylchloride | NA | 1.04E+00 | | na | NA | 9.39E+03 | | na |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | NA | 3.13E+04 | | na | NA | 9.58E+06 | | na |
| 1,1-Dichloroethane | NA | 5.21E+02 | | na | NA | 1.21E+06 | | na |
| 1,2-Dichloroethene | NA | 3.29E+01 | | na | NA | 5.30E+04 | | na |
| Chloroform | 1.70E-05 | 8.35E-02 | 2.03E-04 | no | 1.66E-01 | 9.76E+03 | 1.71E-05 | no |
| 1,2-Dichloroethane | NA | 7.39E-02 | | na | NA | 8.08E+03 | | na |
| Methylchloroform | NA | 1.04E+03 | | na | NA | 1.94E+06 | | na |
| Benzene | 3.30E-04 | 2.49E-01 | 1.33E-03 | no | 3.24E+00 | 1.60E+05 | 2.03E-05 | no |
| Carbontetrachloride | 1.02E-05 | 1.28E-01 | 7.96E-05 | no | 1.07E-02 | 1.28E+05 | 8.37E-08 | no |
| 1,2-Dichloropropane | NA | 9.89E-02 | | na | NA | 5.08E+05 | | na |
| Trichloroethylene | 4.32E-07 | 1.12E+00 | 3.86E-07 | no | 4.24E-03 | 5.37E+05 | 7.90E-09 | no |
| cis 1,3-Dichloro-1-propene | NA | NV | | na | NA | 1.14E+04 | | na |
| trans 1,3-Dichloro-1-propene | NA | NV | | na | NA | NV | | na |
| 1,1,2-Trichloroethane | NA | 1.20E-01 | | na | NA | 1.64E+05 | | na |
| Toluene | 8.81E-05 | 4.02E+02 | 2.20E-07 | no | 9.27E-02 | 1.88E+05 | 4.94E-07 | no |
| 1,2-Dibromoethane | NA | 8.73E-03 | | na | NA | 1.54E+05 | | na |
| Perchloroethylene | 1.56E-05 | 3.31E+00 | 4.70E-06 | no | 3.82E-02 | 6.89E+05 | 5.54E-08 | no |
| Chlorobenzene | 2.24E-05 | 6.20E+01 | 3.61E-07 | no | 9.42E-02 | 1.38E+05 | 6.82E-07 | no |
| Ethylbenzene | 9.72E-06 | 1.06E+03 | 9.18E-09 | no | 4.09E-02 | 5.43E+05 | 7.52E-08 | no |
| m&p-Xylene | 8.19E-06 | 7.30E+02 | 1.12E-08 | no | 3.44E-02 | 6.51E+05 | 5.29E-08 | no |
| Styrene | NA | 1.06E+03 | | na | NA | 2.13E+05 | | na |
| 1,1,2,2-Tetrachloroethane | NA | 3.31E-02 | | na | NA | 2.06E+04 | | na |
| o-Xylene | 8.82E-06 | 7.30E+02 | 1.21E-08 | no | 3.71E-02 | 6.51E+05 | 5.70E-08 | no |
| p-Ethyltoluene | NA | NV | | na | NA | 1.25E+05 | | na |
| 1,3,5-Trimethylbenzene | NA | 6.21E+00 | | na | NA | 3.68E+05 | | na |
| 1,2,4-Trimethylbenzene | NA | 6.21E+00 | | na | NA | 1.80E+05 | | na |
| Benzylchloride | NA | 3.96E-02 | | na | NA | 5.20E+03 | | na |
| m-Dichlorobenzene | 1.01E-06 | 3.29E+00 | 3.07E-07 | no | 4.24E-03 | 3.61E+04 | 1.18E-07 | no |

Table D-2: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds

| Compound (a) | Violet Smoke Grenade | | | | | | | |
|------------------------------|---|---|----------------------------|------|---|---|-------------------------|------|
| | C _{chronic} (µg/m ³) | Health-Based Screening Level (µg/m ³) | C _{chronic} /HBSL | > 1? | C _{acute} (µg/m ³) | Acute Toxicity Value (µg/m ³) | C _{acute} /ATV | > 1? |
| p-Dichlorobenzene | 3.00E-07 | 3.06E-01 | 9.82E-07 | no | 2.94E-03 | 6.61E+05 | 4.45E-09 | no |
| o-Dichlorobenzene | 7.88E-06 | 2.09E+02 | 3.78E-08 | no | 3.31E-02 | 3.01E+05 | 1.10E-07 | no |
| 1,2,4-Trichlorobenzene | NA | 2.08E+02 | | na | NA | 3.71E+04 | | na |
| Hexachlorobutadiene | 1.91E-05 | 8.73E-02 | 2.18E-04 | no | 4.67E-02 | 3.21E+04 | 1.46E-06 | no |
| Phenylacetylene | 3.47E-05 | NV | | na | 3.65E-02 | NV | | na |
| d-Limonene | NA | NV | | na | NA | 3.50E+05 | | na |
| Methylnitrite | 6.24E-06 | NV | | na | 6.56E-03 | NV | | na |
| Acetonitrile | 2.63E-04 | 6.20E+01 | 4.24E-06 | no | 1.11E+00 | 1.01E+05 | 1.10E-05 | no |
| Acrylonitrile | 1.46E-04 | 2.80E-02 | 5.21E-03 | no | 3.57E-01 | 2.20E+04 | 1.62E-05 | no |
| Nitromethane | NA | NV | | na | NA | 1.50E+05 | | na |
| Benzonitrile | 4.19E-04 | NV | | na | 1.76E+00 | 1.50E+04 | 1.17E-04 | no |
| Nitrobenzene | NA | 2.09E+00 | | na | NA | 1.51E+04 | | na |
| 4-Methylbenzonitrile | NA | NV | | na | NA | NV | | na |
| Carbon Disulfide | 1.60E-03 | 7.30E+02 | 2.19E-06 | no | 6.72E+00 | 3.73E+04 | 1.80E-04 | no |
| Thiophene | 4.68E-04 | NV | | na | 4.92E-01 | NV | | na |
| Dimethyldisulfide | 3.68E-05 | NV | | na | 3.87E-02 | 4.00E+01 | 9.68E-04 | no |
| 2-Methylthiophene | 2.64E-05 | NV | | na | 2.78E-02 | NV | | na |
| 3-Methylthiophene | 2.29E-05 | NV | | na | 2.41E-02 | NV | | na |
| Dimethyltrisulfide | 9.54E-05 | NV | | na | 1.00E-01 | NV | | na |
| 1-Chlorobutane | NA | 1.46E+03 | | na | NA | NV | | na |
| 1-Bromo-2-chloroethane | NA | NV | | na | NA | NV | | na |
| 2-Bromo-1-chloropropane | NA | NV | | na | NA | NV | | na |
| 1,2-Dichlorobutane | NA | NV | | na | NA | NV | | na |
| 1,2,3-Trichloropropane | NA | 9.61E-04 | | na | NA | 1.81E+05 | | na |
| 1-Chloro-2-methylbenzene | NA | 7.30E+01 | | na | NA | 3.88E+05 | | na |
| 1-Chloro-3-methylbenzene | NA | NV | | na | NA | NV | | na |
| 1-Chloro-4-ethylbenzene | NA | NV | | na | NA | NV | | na |
| Pentachloro-1-propene | NA | NV | | na | NA | NV | | na |
| Hexachloroethane | 2.07E-05 | 4.80E-01 | 4.31E-05 | no | 2.03E-01 | 2.90E+04 | 7.00E-06 | no |
| 1,2-Dichloro-3-methylbenzene | 5.02E-06 | NV | | na | 5.28E-03 | NV | | na |

Table D-2: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds

| Violet Smoke Grenade | | | | | | | | |
|---------------------------|---|---|----------------------------|------|---|---|-------------------------|------|
| Compound (a) | C _{chronic} (µg/m ³) | Health-Based Screening Level (µg/m ³) | C _{chronic} /HBSL | > 1? | C _{acute} (µg/m ³) | Acute Toxicity Value (µg/m ³) | C _{acute} /ATV | > 1? |
| Carbonyl Sulfide | 1.41E-04 | NV | | na | 5.91E-01 | 9.84E+03 | 6.01E-05 | no |
| Trichloroacetonitrile | NA | NV | | na | NA | NV | | na |
| Dichloroacetonitrile | 5.37E-06 | NV | | na | 5.65E-03 | NV | | na |
| Isothiocyanatomethane | NA | NV | | na | NA | NV | | na |
| 1,1-Dichloro-2-propanone | NA | NV | | na | NA | NV | | na |
| 2-Thiophenecarboxaldehyde | 4.75E-05 | NV | | na | 4.99E-02 | NV | | na |
| Acetaldehyde | 3.24E-04 | 8.73E-01 | 3.71E-04 | no | 7.94E-01 | 1.80E+04 | 4.41E-05 | no |
| Ethanol | 9.21E-06 | NV | | na | 3.87E-02 | 5.64E+06 | 6.87E-09 | no |
| Acrolein | 2.89E-05 | 2.09E-02 | 1.39E-03 | no | 3.04E-02 | 2.30E+02 | 1.32E-04 | no |
| Acetone | 1.79E-03 | 3.40E+02 | 5.27E-06 | no | 7.54E+00 | 2.37E+06 | 3.18E-06 | no |
| Propanal | 1.33E-05 | NV | | na | 5.59E-02 | 7.50E+04 | 7.46E-07 | no |
| Furan | 1.29E-04 | 3.70E+00 | 3.50E-05 | no | 5.44E-01 | 1.67E+02 | 3.26E-03 | no |
| 2-Propanol | 1.54E-06 | NV | | na | 6.47E-03 | 9.84E+05 | 6.57E-09 | no |
| Methacrolein | 2.98E-05 | NV | | na | 3.13E-02 | NV | | na |
| MTBE | NA | 3.10E+03 | | na | NA | 4.32E+05 | | na |
| Methyl-vinyl ketone | 2.39E-05 | NV | | na | 1.00E-01 | 8.61E+01 | 1.16E-03 | no |
| 2,3-Butanedione | 9.72E-05 | NV | | na | 1.02E-01 | NV | | na |
| Butanal | 9.51E-06 | NV | | na | 4.00E-02 | 7.38E+04 | 5.42E-07 | no |
| 2-Butanone | 8.67E-05 | 1.00E+03 | 8.67E-08 | no | 3.64E-01 | 8.85E+05 | 4.12E-07 | no |
| 2-Methylfuran | 2.77E-05 | NV | | na | 2.91E-02 | NV | | na |
| 3-Methylfuran | 4.74E-06 | NV | | na | 4.99E-03 | NV | | na |
| trans-2-Butenal | 3.12E-05 | 3.54E-03 | 8.82E-03 | no | 7.66E-02 | NV | | na |
| Tetrahydrofuran | NA | 9.89E-01 | | na | NA | 7.38E+05 | | na |
| 3-Methyl-2-butanone | NA | 8.30E+01 | | na | NA | 3.07E+05 | | na |
| Acetic Acid | 3.82E-05 | NV | | na | 1.61E-01 | 3.68E+04 | 4.37E-06 | no |
| 1-Butanol | NA | 3.65E+02 | | na | NA | 1.52E+05 | | na |
| 1-Penten-3-one | NA | NV | | na | NA | NV | | na |
| 2-Pentanone | NA | NV | | na | NA | 8.80E+05 | | na |
| Pentanal | NA | NV | | na | NA | NV | | na |
| 2,3-Pentanedione | NA | NV | | na | NA | NV | | na |

Table D-2: Comparison of Air Concentrations With Health-Based Values: Volatile Organic Compounds

| Compound (a) | Violet Smoke Grenade | | | | | | |
|------------------------------|---|---|----------------------------|------|---|---|-------------------------|
| | C _{chronic} (µg/m ³) | Health-Based Screening Level (µg/m ³) | C _{chronic} /HBSL | > 1? | C _{acute} (µg/m ³) | Acute Toxicity Value (µg/m ³) | C _{acute} /ATV |
| 1,2-Dichloro-2-methylpropane | NA | NV | | na | NA | NV | na |
| 3-Pentanone | NA | NV | | na | NA | NV | na |
| 2,5-Dimethylfuran | 4.73E-06 | NV | | na | 4.97E-03 | NV | na |
| 4-Methyl-2-pentanone | NA | 8.30E+01 | | na | NA | 3.07E+05 | na |
| trans-3-Penten-2-one | 8.94E-06 | NV | | na | 9.39E-03 | NV | na |
| Cyclopentanone | NA | NV | | na | NA | NV | na |
| 2-Hexanone | NA | 5.11E+00 | | na | NA | 4.09E+04 | na |
| Hexanal | 1.87E-05 | NV | | na | 1.96E-02 | NV | na |
| 3-Furaldehyde | 9.29E-05 | NV | | na | 9.77E-02 | NV | na |
| 2-Cyclopenten-1-one | NA | NV | | na | NA | NV | na |
| 2-Furaldehyde | 2.30E-04 | 5.20E+01 | 4.41E-06 | no | 9.65E-01 | 7.86E+03 | 1.23E-04 |
| 1-Acetoxyacetone | NA | NV | | na | NA | NV | na |
| 2-Heptanone | NA | NV | | na | NA | 7.01E+05 | na |
| Heptanal | NA | NV | | na | NA | NV | na |
| 5-Methyl-2-furaldehyde | NA | NV | | na | NA | NV | na |
| Benzaldehyde | 6.86E-05 | 3.65E+02 | 1.88E-07 | no | 2.88E-01 | 1.50E+04 | 1.92E-05 |
| Benzofuran | 2.28E-05 | NV | | na | 2.40E-02 | NV | na |
| Octanal | 1.11E-05 | NV | | na | 1.16E-02 | NV | na |
| Acetophenone | NA | NV | | na | NA | 3.00E+04 | na |
| 2-Nonanone | NA | NV | | na | NA | NV | na |
| Nonanal | NA | NV | | na | NA | NV | na |

Footnotes:

(a) Items in bold represent duplicate values for those compounds that are common for Method TO-14 and TO-12.

NA = Not applicable

na = Not available because health-based screening value is not available or not applicable because compound was not detected.

NV = No value

C_{chronic} = Chronic time-averaged concentration

HBSL = Chronic health-based screening level

C_{acute} = Acute concentration

ATV = Acute toxicity value

Table D-3: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds

List okay - hy 20 Jul 00

List okay - hy 20 jul 00

Violet Smoke Grenade

| Compound | C _{chronic} (µg/m ³) | Health-Based Screening Level (µg/m ³) | C _{chronic} / HBSL | > 1? | C _{acute} (µg/m ³) | Acute Toxicity Value (µg/m ³) | C _{acute} /ATV | > 1? |
|-------------------------------|--|---|--------------------------------|------|--|--|-------------------------|------|
| Particulate/Vapor-phase SVOCs | | | | | | | | |
| N-Nitrosodimethylamine | NA | 1.40E-04 | | na | NA | 2.50E+03 | | na |
| Pyridine | NA | 3.65E+00 | | na | NA | 4.85E+04 | | na |
| 2-Picoline | NA | NV | | na | NA | NV | | na |
| Methyl methanesulfonate | NA | NV | | na | NA | NV | | na |
| N-Nitrosomethylethylamine | NA | 3.06E-04 | | na | NA | NV | | na |
| N-Nitrosodiethylamine | NA | 4.47E-05 | | na | NA | NV | | na |
| Ethyl methanesulfonate | NA | NV | | na | NA | NV | | na |
| Phenol | NA | 2.19E+03 | | na | NA | NV | | na |
| Aniline | NA | 1.06E+00 | | na | NA | 3.85E+05 | | na |
| bis(2-Chloroethyl)ether | NA | 5.80E-03 | | na | NA | 3.00E+04 | | na |
| Pentachloroethane | NA | NV | | na | NA | 5.85E+04 | | na |
| 2-Chlorophenol | NA | 1.83E+01 | | na | NA | 3.00E+04 | | na |
| 1,3-Dichlorobenzene | NA | NV | | na | NA | 5.25E+03 | | na |
| 1,4-Dichlorobenzene | NA | 2.80E-01 | | na | NA | NV | | na |
| Benzyl alcohol | NA | 1.10E+03 | | na | NA | 6.61E+05 | | na |
| 2-Methylphenol | NA | 1.83E+02 | | na | NA | 5.53E+04 | | na |
| 1,2-Dichlorobenzene | NA | 2.09E+02 | | na | NA | 6.63E+04 | | na |
| bis(2-Chloroisopropyl)ether | NA | 1.92E-01 | | na | NA | 3.01E+05 | | na |
| o-Toluidine | NA | 2.80E-02 | | na | NA | 6.99E+04 | | na |
| 4-Methylphenol/3-Methylphenol | NA | 1.83E+01 | | na | NA | 2.63E+04 | | na |
| N-Nitroso-di-n-propylamine | NA | 9.61E-04 | | na | NA | 6.63E+04 | | na |
| Acetophenone | NA | 2.10E-02 | | na | NA | 2.00E+02 | | na |
| N-Nitrosomorpholine | NA | NV | | na | NA | 3.00E+04 | | na |
| N-Nitrosopyrrolidine | NA | 3.15E-03 | | na | NA | 3.00E+04 | | na |
| Hexachloroethane | NA | 4.80E-01 | | na | NA | NV | | na |
| Nitrobenzene | NA | 2.09E+00 | | na | NA | 2.90E+04 | | na |
| N-Nitrosopiperidine | NA | NV | | na | NA | 1.51E+04 | | na |
| Isophorone | NA | 7.08E+00 | | na | NA | NV | | na |
| 2,4-Dimethylphenol | NA | 7.30E+01 | | na | NA | 2.83E+04 | | na |
| 2-Nitrophenol | NA | NV | | na | NA | NV | | na |
| bis(2-Chloroethoxy)methane | NA | NV | | na | NA | NV | | na |

Table D-3: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds

List okay - hy 20 jul 00

List okay - hy 20 jul 00

| Violet Smoke Grenade | | | | | | | | |
|----------------------------|--|---|--------------------------------|------|--|--|--------------------------|------|
| Compound | C _{chronic} (µg/m ³) | Health-Based Screening Level (µg/m ³) | C _{chronic} / HBSL | > 1? | C _{acute} (µg/m ³) | Acute Toxicity Value (µg/m ³) | C _{acute} / ATV | > 1? |
| Benzoic acid | NA | 1.50E+04 | | na | NA | 1.25E+04 | | na |
| 2,4-Dichlorophenol | NA | 1.10E+01 | | na | NA | 3.00E+04 | | na |
| 1,2,4-Trichlorobenzene | NA | 2.08E+02 | | na | NA | 3.71E+04 | | na |
| Naphthalene | NA | 3.13E+00 | | na | NA | 7.86E+04 | | na |
| p-Chloroaniline | NA | 1.46E+01 | | na | NA | 3.00E+04 | | na |
| 2,6-Dichlorophenol | NA | NV | | na | NA | 3.00E+04 | | na |
| Hexachloropropene | NA | NV | | na | NA | NV | | na |
| Hexachlorobutadiene | NA | 8.62E-02 | | na | NA | 3.21E+04 | | na |
| Dimethylphenethylamine | NA | 3.65E+00 | | na | NA | NV | | na |
| N-Nitroso-di-n-butylamine | NA | 1.20E-03 | | na | NA | NV | | na |
| 4-Chloro-3-methylphenol | NA | NV | | na | NA | NV | | na |
| Safrole | NA | NV | | na | NA | NV | | na |
| 2-Methylnaphthalene | NA | NV | | na | NA | 2.00E+04 | | na |
| 1,2,4,5-Tetrachlorobenzene | NA | 1.10E+00 | | na | NA | 3.00E+04 | | na |
| Hexachlorocyclopentadiene | NA | 7.30E-02 | | na | NA | 2.23E+02 | | na |
| 2,4,6-Trichlorophenol | NA | 6.20E-01 | | na | NA | 3.00E+04 | | na |
| 2,4,5-Trichlorophenol | NA | 3.65E+02 | | na | NA | 3.00E+04 | | na |
| Isosafrole | NA | NV | | na | NA | NV | | na |
| 2-Chloronaphthalene | NA | 2.92E+02 | | na | NA | 6.00E+02 | | na |
| 2-Nitroaniline | NA | 2.09E-01 | | na | NA | NV | | na |
| 1,4-Naphthoquinone | NA | NV | | na | NA | 2.50E+02 | | na |
| Dimethylphthalate | NA | 3.65E+04 | | na | NA | 1.50E+04 | | na |
| 1,3-Dinitrobenzene | NA | 3.65E-01 | | na | NA | 3.00E+03 | | na |
| 2,6-Dinitrotoluene | NA | 3.65E+00 | | na | NA | 6.00E+02 | | na |
| Acenaphthylene | NA | NV | | na | NA | 2.00E+02 | | na |
| 3-Nitroaniline | NA | NV | | na | NA | NV | | na |
| 4-Nitrophenol | NA | 2.90E+01 | | na | NA | 3.00E+04 | | na |
| 2,4-Dinitrophenol | NA | 7.30E+00 | | na | NA | 7.50E+03 | | na |
| Acenaphthene | NA | 2.19E+02 | | na | NA | 1.25E+03 | | na |
| 2,4-Dinitrotoluene | NA | 7.30E+00 | | na | NA | 6.00E+02 | | na |
| Dibenzofuran | NA | 1.46E+01 | | na | NA | 1.50E+00 | | na |
| Pentachlorobenzene | NA | 2.92E+00 | | na | NA | 3.00E+04 | | na |

Table D-3: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds

List okay - hy 20 jul 00

Violet Smoke Grenade

| Compound | C _{chronic} (µg/m ³) | Health-Based Screening Level (µg/m ³) | C _{chronic} / HBSL | > 1? | C _{acute} (µg/m ³) | Acute Toxicity Value (µg/m ³) | C _{acute} / ATV | > 1? |
|----------------------------|--|---|--------------------------------|------|--|--|--------------------------|------|
| 1-Naphthylamine | NA | NV | | na | NA | 3.50E+04 | | na |
| 2-Naphthylamine | NA | NV | | na | NA | 7.50E+03 | | na |
| 2,3,4,6-Tetrachlorophenol | NA | 1.10E+02 | | na | NA | NV | | na |
| Diethylphthalate | NA | 2.92E+03 | | na | NA | 1.50E+04 | | na |
| 4-Chlorophenylphenyl ether | NA | NV | | na | NA | NV | | na |
| Fluorene | NA | 1.46E+02 | | na | NA | 7.50E+04 | | na |
| 5-Nitro-o-toluidine | NA | 2.00E-01 | | na | NA | NV | | na |
| 4-Nitroaniline | NA | NV | | na | NA | 9.00E+03 | | na |
| 4,6-Dinitro-2-methylphenol | NA | 3.65E-01 | | na | NA | 5.00E+02 | | na |
| Diphenylamine/N-NitrosodPA | NA | 1.37E-04 | | na | NA | 2.50E+03 | | na |
| sym-Trinitrobenzene | NA | 1.10E+02 | | na | NA | 3.00E+04 | | na |
| Diallylate | NA | 1.10E-01 | | na | NA | NV | | na |
| Phenacetin | NA | NV | | na | NA | 3.00E+04 | | na |
| 4-Bromophenylphenyl ether | NA | NV | | na | NA | NV | | na |
| Hexachlorobenzene | NA | 4.18E-03 | | na | NA | 7.50E+01 | | na |
| 4-Aminobiphenyl | NA | NV | | na | NA | 1.50E+03 | | na |
| Pronamide | NA | 2.74E+02 | | na | NA | NV | | na |
| Pentachlorophenol | NA | 5.60E-02 | | na | NA | 1.50E+03 | | na |
| Pentachloronitrobenzene | NA | 2.59E-02 | | na | NA | 1.50E+03 | | na |
| Phenanthrene | NA | NV | | na | NA | 2.00E+03 | | na |
| Anthracene | NA | 1.10E+03 | | na | NA | 6.00E+03 | | na |
| Carbazole | NA | 3.36E-01 | | na | NA | NV | | na |
| Di-n-butylphthalate | NA | 3.65E+02 | | na | NA | 1.50E+04 | | na |
| 4-Nitroquinoline-1-oxide | NA | NV | | na | NA | NV | | na |
| Methapyrene | NA | NV | | na | NA | NV | | na |
| Fluoranthene | NA | 1.46E+02 | | na | NA | 3.00E+01 | | na |
| Benzidine | NA | 2.90E-05 | | na | NA | 5.00E+02 | | na |
| Pyrene | NA | 1.10E+02 | | na | NA | 1.50E+04 | | na |
| p-Dimethylaminoazobenzene | NA | NV | | na | NA | 7.50E+04 | | na |
| Chlorobenzilate | NA | 2.49E-02 | | na | NA | 2.50E+02 | | na |
| Kepone | NA | 3.74E-04 | | na | NA | 1.00E+02 | | na |
| Butylbenzylphthalate | NA | 7.30E+02 | | na | NA | 5.00E+05 | | na |

List okay - by 20 jul 00

Table D-3: Comparison of Air Concentrations With Health-Based Values: Semi-Volatile Organic Compounds

List okay - hy 20 jul 00

List okay - hy 20 jul 00

Violet Smoke Grenade

| Compound | C _{chronic} (µg/m ³) | Health-Based Screening Level (µg/m ³) | C _{chronic} / HBSL | > 1? | C _{acute} (µg/m ³) | Acute Toxicity Value (µg/m ³) | C _{acute} / ATV | > 1? |
|--|--|---|--------------------------------|------|--|--|--------------------------|------|
| 3,3'-Dimethylbenzidine | NA | 7.30E-04 | | na | NA | 3.00E+00 | | na |
| 2-Acetylaminofluorene | NA | NV | | na | NA | 2.50E+03 | | na |
| bis(2-Ethylhexyl)phthalate | NA | 4.80E-01 | | na | NA | 1.00E+04 | | na |
| 3,3'-Dichlorobenzidine | NA | 1.50E-02 | | na | NA | 6.21E+03 | | na |
| Benz(a)anthracene | NA | 2.17E-02 | | na | NA | 6.00E+02 | | na |
| Chrysene | NA | 2.17E+00 | | na | NA | 2.00E+02 | | na |
| Di-n-octylphthalate | NA | 7.30E+01 | | na | NA | 1.50E+05 | | na |
| 7,12-Dimethylbenz(a)anthracene | NA | NV | | na | NA | NV | | na |
| Benzo(b)fluoranthene | NA | 2.17E-02 | | na | NA | NV | | na |
| Benzo(k)fluoranthene | NA | 2.17E-01 | | na | NA | NV | | na |
| Benzo(a)pyrene | NA | 2.17E-03 | | na | NA | 7.50E+03 | | na |
| 3-Methylcholanthrene | NA | NV | | na | NA | 1.50E+03 | | na |
| Indeno(1,2,3-cd)pyrene | NA | 2.17E-02 | | na | NA | NV | | na |
| Dibenz(a,h)anthracene | NA | 2.17E-03 | | na | NA | 3.00E+04 | | na |
| Benzo(g,h,i)perylene | NA | NV | | na | NA | 3.00E+04 | | na |
| 2-(2-quinolyl)-(H)-indene-1,3-(2H)-dione | NA | NV | | na | NA | NV | | na |
| Benzanthrone | NA | NV | | na | NA | NV | | na |
| Tetrachloroethene | NA | 3.31E+00 | | na | NA | 6.78E+05 | | na |
| (1,2-dichloroethyl)-benzene | NA | NV | | na | NA | NV | | na |
| 4-phenoxy-2(1H)-quinolinone | 2.15E-01 | NV | | na | 2.26E+02 | NV | | na |
| 3-(phenylhydrazono)-1H-Indole-2,3-dione | 2.15E-01 | NV | | na | 2.26E+02 | NV | | na |
| 4-1,2,4-oxadiazolin-3-one-2,5-diphenyl-della | 1.07E-02 | NV | | na | 1.13E+01 | NV | | na |
| 2-amino-9,10-anthracenedione | NA | NV | | na | NA | NV | | na |

Footnotes:

NA = Not applicable

na = Not available because health-based screening value is not available or not applicable because compound was not detected.

NV = No value

C_{chronic} = Chronic time-averaged concentration

HBSL = Chronic health-based screening level

C_{acute} = Acute concentration

ATV = Acute toxicity value

Footnotes:

NA = Not applicable

na = Not available because health-based screening value is not available or not applicable because compound was not detected.

NV = No value

C_{chronic} = Chronic time-averaged concentration

HBSL = Chronic health-based screening level

C_{acute} = Acute concentration

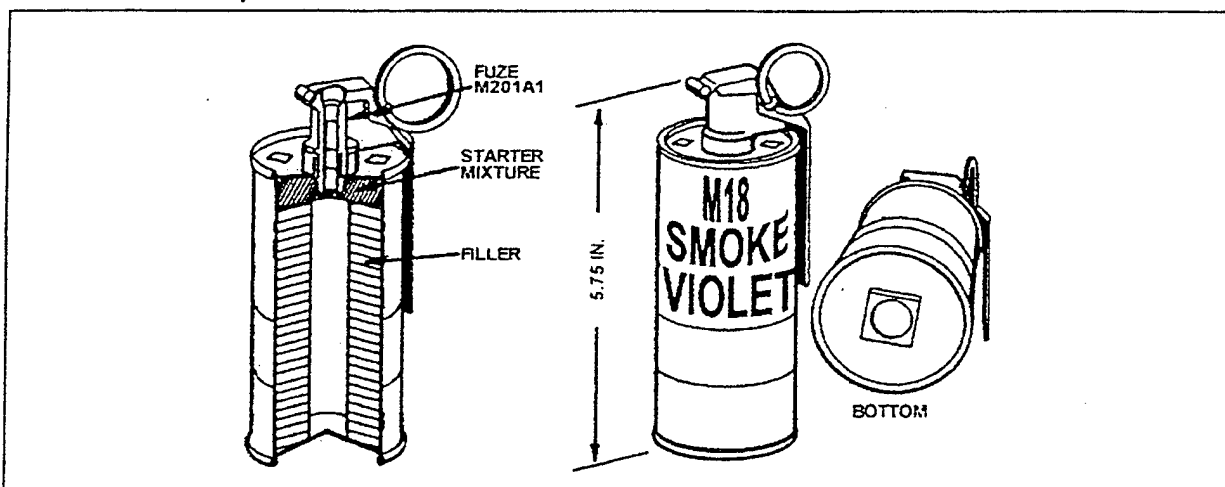
ATV = Acute toxicity value

APPENDIX E

FACT SHEET SUBMITTED TO AEC

United States Army Environmental Center Pyrotechnics Fact Sheet

M18 Violet-Colored Smoke Grenade *Department of Defense Identification Code: G955*



Breathing air emissions from the violet-colored smoke grenade will not impact the health of residents who live near Army training facilities.

WHAT ARE PYROTECHNICS?

The terms pyrotechnics and fireworks are often used interchangeably. Pyrotechnics are devices that give off smoke, light, and/or a loud noise when activated. In the military, pyrotechnics are used for signaling, obscuring, and illuminating during training and combat.

WHAT IS THE M18?

The M18 smoke grenade is a type of pyrotechnic device used by troops for ground-to-ground or ground-to-air signaling. The M18 may be filled with one of four different smoke colors. These different colored smoke signals can be seen over great distances when used against a terrain background of contrasting colors. The M18 is 5.75 inches long, 2.50 inches in diameter, and weighs 19 ounces.

HOW IS THE M18 USED?

The M18 contains a delay-igniting fuze so that smoke is not released immediately after the grenade is activated. This allows the user to throw the grenade, usually to a distance of about 35 meters (115 feet) before smoke is produced. The M18 will emit a cloud of colored smoke for 50 to 90 seconds. This colored smoke can be used for different purposes. For example, it can be used to mark friendly force locations for other ground troops. It can also be used to mark a landing zone during operations such as medical evacuation.

WHERE IS THE VIOLET-COLORED M18 USED?

The violet-colored M18 is used during many Army training events. These events are held at nearly every Army training

installation. At most locations, the training areas are at least 1000 meters (over half a mile) away from populated areas. In general, five of these items are used during a day of training, which typically occurs five times per year.

WHAT IS IN THE VIOLET-COLORED M18?

The body of the violet-colored M18 consists of a thin cylinder of sheet metal that is filled with a smoke mixture containing violet dye. The filler is topped with a starter mixture composed mostly of potassium nitrate.

WILL BREATHING AIR EMISSIONS FROM THE VIOLET-COLORED M18 AFFECT MY HEALTH?

To answer this question, the U.S. Army Environmental Center tested the air emissions from the violet-colored M18. The U.S. Army Center for Health Promotion and Preventive Medicine then determined if there would be a potential for health effects from inhalation to residents living near training areas. Results showed that residents breathing air as close as 100 meters (328 feet) from the activation site are safe from these emissions.

HOW WAS THE STUDY DONE?

To gather data for the study, airborne emissions were collected by activating the violet-colored M18 in a test chamber. The air in the chamber was tested to identify the types and the amount of substances released. More than 300 substances were looked for during this part of the study.

This information was then used in an air model (a computer program that

allows estimation of air concentrations) to determine the amount of each substance, to which someone living near a training area might be exposed. Downwind concentrations were estimated based on a typical use scenario for the violet-colored M18. Since the study does not look at a specific training area, the assumptions used in the model will in most cases, predict higher downwind air concentrations than those expected at an actual training site.

These estimated air concentrations were then compared to safe screening levels established by the U.S. Environmental Protection Agency and other agencies. If the air concentrations are below these screening levels, they are considered safe for everyone, including sensitive people such as the sick, elderly, and children.

WHAT ARE THE LIMITATIONS OF THIS STUDY?

Many steps were taken to ensure that the results of this study are protective of everyone who lives close to training areas. However, limitations do exist with this study. For example, the study does not consider exposure to other types of munitions that could also be used during the same training event. Due to these limitations, conservative model conditions were used to ensure the protection of public health from inhalation of the violet-colored M18 air emissions.

WHERE CAN I GET MORE INFORMATION?

For more information on the M18 and other military munitions call the Army Environmental Hotline at 1-800-USA-3845, visit our website at www.aec.army.mil, or email us at t2hotline@aec.apgea.army.mil.